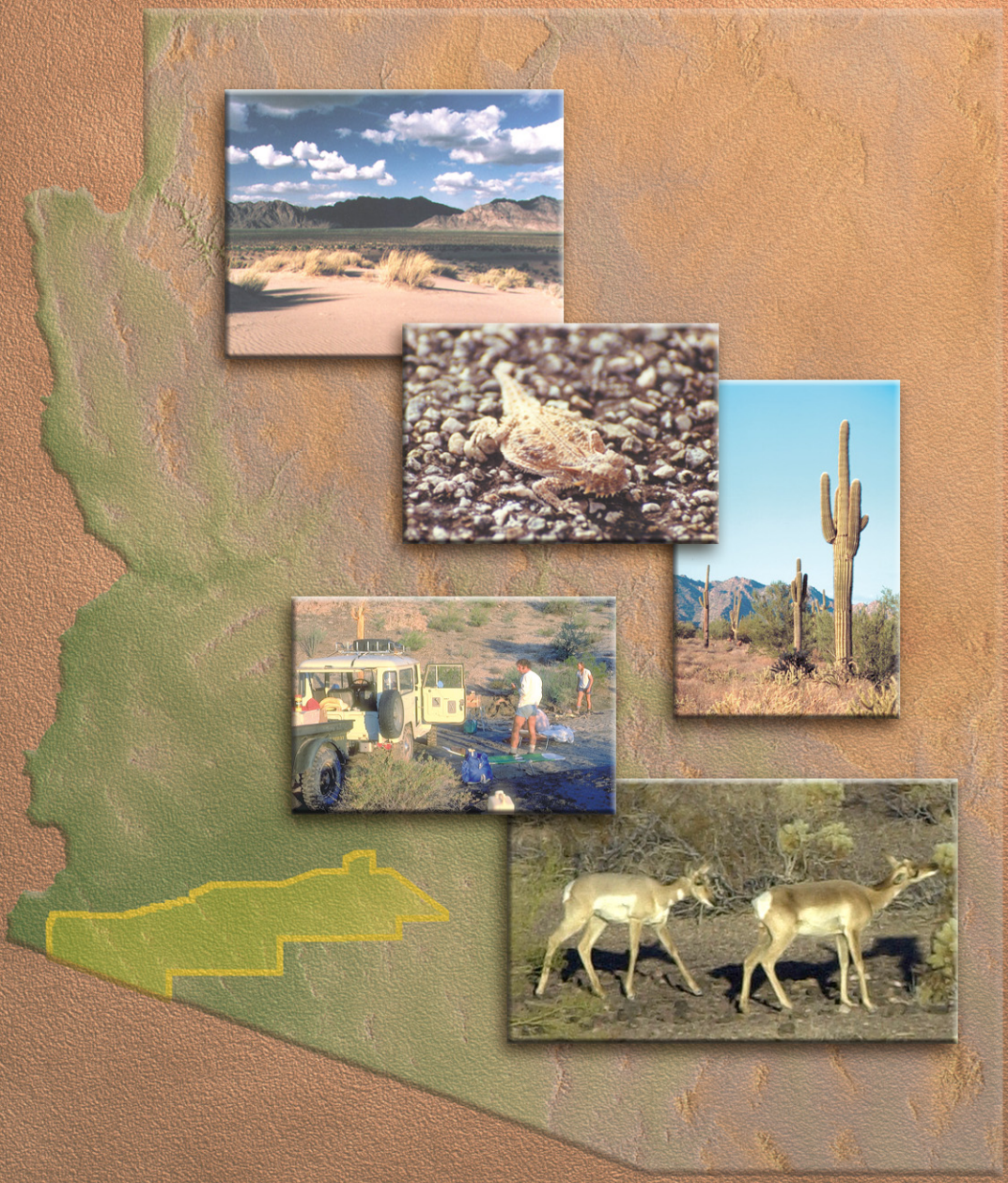
Draft Environmental Impact Statement - Volume 1

Barry M. Goldwater Range

Proposed Integrated Natural Resources Management Plan



Lead Agencies:

Departments of the Air Force, Navy, and Interior

Cooperating Agency:

Arizona Game and Fish Department

FEBRUARY 2003

PRIVACY ADVISORY

Comments on the attached draft Environmental Impact Statement (EIS) are requested. Letters or other public comment documents provided to the Department of the Air Force or Department of the Navy may be published in the final EIS. Information provided will be used only to improve upon issues identified in the draft EIS. Comments will be addressed in the final EIS and made available to the public. However, only the name of the individual and specific comments will be disclosed.

COVER SHEET

DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR THE BARRY M. GOLDWATER RANGE INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN

Submitted Pursuant to Public Law 106-65 and 16 United States Code (U.S.C.) 670

Lead Agencies:	U.S. Department of the Air Force U.S. Department of the Navy U.S. Department of the Interior
Cooperating Agency:	Arizona Game and Fish Department
Title of the Proposed Action:	Integrated Natural Resources Management Plan for the Barry M. Goldwater Range
Location of the Proposed Action:	State of Arizona, Counties of Yuma, Pima, and Maricopa
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Mail Comments on the Draft Environmental Impact Statement to:	BMGR INRMP P.O. Box 67132 Phoenix, Arizona 85082-7132
Comment Period:	The 60-day comment period for this draft Environmental Impact Statement (EIS) is calculated from the date the Notice of Availability appears in the Federal Register. The comment period is expected to close on or about 7 May 2003.

ABSTRACT

This EIS addressed proposed management alternatives for the Barry M. Goldwater Range (BMGR) Integrated Natural Resources Management Plan (INRMP). The BMGR, located in southwestern Arizona, has served as a military training range since 1941. The land withdrawal, which sets the BMGR aside for military training purposes, was renewed by the Military Lands Withdrawal Act of 1999 (Public Law 106-65). In compliance with this Act, the Air Force and Marine Corps, in partnership with the Department of the Interior and the Arizona Game and Fish Department, will manage the natural resources present on the BMGR in accordance with the Sikes Act (16 U.S.C. 670).

The proposed action is a combination of the alternative management strategies. The no-action alternative would result in continuation of the existing management provisions established by the Bureau of Land Management in 1990. Impacts to earth resources, water resources, climate and air resources, general vegetation, general wildlife and wildlife habitats, protected species, wildfire management, grounds maintenance, public utility/transportation corridors, special management areas, outdoor recreation, public health and safety, law enforcement, transboundary and domestic perimeter land use, cultural resources, visual resources, hazardous materials and waste, socioeconomics, and noise are discussed.

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LIST OF ACRONYMS

$\mu g/m^3$	micrograms per cubic meter
ACC	Air Combat Command
ACEC	Area of Critical Environmental Concern
ACHP	Advisory Council on Historic Preservation
ACMI	Air Combat Maneuvering Instrumentation
ACMR	Air Combat Maneuvering Range
ACOE	Army Corps of Engineers
ACT	Air Combat Tactics
ADC	Air Defense Command
ADEQ	Arizona Department of Environmental Quality
ADOT	Arizona Department of Transportation
ADWR	Arizona Department of Water Resources
AETC	Air Education and Training Command
AFAF	Air Force Auxiliary Field
AFB	Air Force Base
AFI	Air Force Instruction
AFRC	Air Force Reserve Command
AGFD	Arizona Game and Fish Department
AGL	Above Ground Level
AGTS	Aerial Gunnery Target System
AHB	Attack Helicopter Battalion
AICUZ	Air Installation Compatible Use Zone
AIM	Air Intercept Missile
ANG	Air National Guard
ANSI	American Natural Standards Institute
APZ	Accident Potential Zone
ARNG	Army National Guard
ARPA	Archaeological Resources Protection Act
ARS	Arizona Revised Statutes
ASDM	Arizona-Sonora Desert Museum
ASH	Area Service Highway
ASM	Arizona State Museum
ASMI	Arizona State Mine Inspector
ATV	all-terrain vehicle
AUM	animal unit month
AUX	Auxiliary Airfield
BASH	Bird Aircraft Strike Hazard
BDU	Bomb Dummy Unit
BEC	Barry M. Goldwater Range Executive Council
BLM	Bureau of Land Management
BMGR	Barry M. Goldwater Range
BMGR—East	Eastern (Air Force) portion of the BMGR
BMGR—West	Western (Marine Corps) portion of the BMGR
BOR	Bureau of Reclamation

CAA	Clean Air Act
CDNL	C-Weighted Day-Night Average Sound Level
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liabilities Act
CFR	Code of Federal Regulations
CO	carbon monoxide
CWA	Clean Water Act
DART	Deployable Aerial Rigged Target
dB	decibel
dBA	A-weighted decibel
DES	Department of Economic Security
DNL	Day-Night Average Sound Level
DNL_{MR}	Sudden Onset Rate Adjusted Monthly Day-Night Average Sound Level
DoD	Department of Defense
DOI	Department of the Interior
DZ	Drop Zone
EA	Environmental Assessment
EIS	Environmental Impact Statement
E.O.	Executive Order
EOD	Explosive Ordnance Disposal
EPA	Environmental Protection Agency
ESA	Endangered Species Act
EW	Electronic Warfare
FAA	Federal Aviation Administration
FCLP	field carrier landing practice
FEMA	Federal Emergency Management Agency
FICUN	Federal Interagency Committee on Urban Noise
FIREX	Firing Exercise
FLPMA	Federal Land Policy Management Act of 1976
FONSI	Finding of No Significant Impact
FW	Fighter Wing
FY	Fiscal Year
GIS	Geographic Information System
GMP	General Management Plan
gpm	gallons per minute
GRMDS	Goldwater Range Measurement and Debriefing System
HAWK	Homing All the Way Killer
HE	high explosives
HMA	Habitat Management Area
HMP	Habitat Management Plan
HVAR	High Velocity Aircraft Rocket
Hz	Hertz

ICBM	Intercontinental Ballistic Missile
ICRMP	Integrated Cultural Resources Management Plan
IEC	Intergovernmental Executive Committee
INEGI	Instituto Nacional de Estadistica Geographia Y Informatica
INRMP	Integrated Natural Resources Management Plan
IRP	Installation Restoration Program
ISST	Intercontinental Ballistic Missile Silo Superhardening Technology
JDAM	Joint Direct Attack Munition
km	kilometers
kV	kilovolt
LAFR	Luke Air Force Range
L_{cdn}	C-Weighted Day-Night Average Sound Level
L_{dn}	Day-Night Average Sound Level
L_{dnmr}	Sudden Onset Rate Adjusted Monthly Day-Night Average Sound Level
L_{eg}	One-Hour Average Sound Level
LEIS	Legislative Environmental Impact Statement
LHA	Landing Helicopter Assault
LPG	Liquid Petroleum Gas
MAG	Maricopa Association of Governments
MAV	Multiple Aim-point Validation
MAW	Marine Aircraft Wing
MAWTS	Marine Aviation Weapons and Tactics Squadron
MBTA	Migratory Bird Treaty Act
MCAS	Marine Corps Air Station
mg/kg	milogram per kilogram
mg/L	milligrams per liter
$mglm^3$	milligrams per cubic meter
MK	Mark
MLT	Mobile Land Target
MLWA	Military Lands Withdrawal Act
mm	millimeter
MOA	Military Operations Area
MOU	Memorandum of Understanding
MPO	Metropolitan Planning Organization
m/s	meters per second
MSL	Mean Sea Level
MTR	Military Training Route
MX	missile experimental
NAAQS	National Ambient Air Quality Standards
NAFTA	North American Free Trade Agreement
NAU	Northern Arizona University
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NLR	noise level reduction

NM	National Monument
NOA	Notice of Availability
NOI	Notice of Intent
NO_2	nitrogen dioxide
NO_x	oxides of nitrogen
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRCR	Natural Resource Conservation and Recovery Act
NRCS	Natural Resources Conservation Service
NRPT	Natural Resources Planning Team
NWR	National Wildlife Refuge
ORV	Off-Road Vehicle
PAG	Pima Association of Governments
PCB	Polychlorinated Biphenyl
PDAI	Phelps Dodge Ajo Incorporated
PDZ	Parachute Drop Zone
P.L.	Public Law
P.L.O.	Public Land Order
PM_{10}	particle matter with a diameter of 10 microns or less
$PM_{2.5}$	particle matter with a diameter of 2.5 microns or less
POLs	petroleum, oils, and lubricants
ppm	parts per million
PSD	Prevention of Significant Deterioration
psf	pounds per square foot
R	Restricted (airspace)
RACM	Reasonably Available Control Measures
RACT	Reasonably Available Control Technology
RAICUZ	Range Air Installation Compatible Use Zone
RARE	Roadless Area Review and Evaluation
RCRA	Resource Conservation and Recovery Act
RMCP	Range Munitions Consolidation Point
RMO	Range Management Office
RMP	Resource Management Plan
ROCC	Range Operations Control Center
ROD	Record of Decision
RV	Recreation Vehicle
SAIA	Sikes Act Improvement Act
SAM	Surface-to-Air Missile
SCS	Soil Conservation Service
SEL	Sound Exposure Level
SHPO	State Historic Preservation Office
SIP	State Implementation Plan
SLT	Simulated Laser Target
SMCRA	Surface Mining Control and Reclamation Act
SO_2	sulfur dioxide

SPCC	Spill Prevention/Control and Countermeasure Plan
SRMA	Special Recreation Management Area
SUV	sport utility vehicle
TAC	Tactical
TACTS	Tactical Aircrew Combat Training System
TDS	total dissolved solids
TIS	Tracking and Instrumentation Subsystem
TLZ	Tactical Landing Zone
TNC	The Nature Conservancy
TNT	trinitrotoluene
TOSS	Television Ordnance Scoring System
TSP	total suspended particulate matter
UDA	Undocumented aliens
U.S.C.	United States Code
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UST	underground storage tank
UXO	unexploded ordnance
VOC	volatile organic compound
VRM	Visual Resource Management
WAATS	Western ARNG Aviation Training Site
WC	Wildlife of Special Concern in Arizona
WISS	Weapons Impact Scoring System
WTI	Weapons Tactics Instructor
YTRC	Yuma Training Range Complex

GLOSSARY

Adaptive Management. (1) The process of implementing policy decisions as scientifically driven management experiments that test predictions and assumptions in management plans, and using the resulting information to improve the plans (Noss and Cooperrider 1994); (2) A mechanism for integrating scientific knowledge and experience for the purpose of understanding and managing natural systems (Holling 1978; Walters 1986 *In* Leslie and others 1996 – The Nature Conservancy [TNC]).

Adit. An almost horizontal entry or passageway into a mine.

Aircrew. The crew members who operate an aircraft or its various systems.

Alluvial Fan. An outspread, gently sloping mass of alluvium deposited by a stream; particularly in arid regions where a stream issues from a narrow canyon onto a valley floor. Viewed from above, the alluvium has the shape of a fan.

Alluvium (as in alluvial deposits and alluvial fans). Deposits of organic and inorganic material made by streams on river beds, floodplains, and alluvial fans; particularly deposits of clay or silty clay laid down during time of flood.

Animal Unit Month. The amount of forage needed by an "animal unit" grazing for one month. The animal unit is defined as one mature 1,000 pound cow and a suckling calf.

Attainment area. A geographic area in which levels of a criteria air pollutant meet the health-based primary standard (national ambient air quality standard, or NAAQS) for the pollutant. An area may have an acceptable level for one criteria air pollutant, but may have unacceptable levels for others. Thus, an area could be both attainment and nonattainment at the same time. Attainment areas are defined using federal pollutant limits set by the Environmental Protection Agency (EPA 2002).

Bajada. When several alluvial fans laterally coalesce, the resulting feature is called a bajada (Spanish for "that which is below"). Bajadas may be hundreds to thousands of feet thick, and may hold deposits of water deep beneath the surface.

Best Management Practices. Resource management decisions that are based on the latest professional and technical standards for the protection, enhancement, and rehabilitation of natural and cultural resources (Department of Defense [DoD] Instruction 4715.3).

Biodiversity. The variety of life forms and processes and the environment in which they occur. Biodiversity includes the number and variety of living organisms, the genetic differences among

them, the communities and ecosystems in which they occur, and the ecological and evolutionary processes that keep them functioning, yet ever changing and adapting (DoD 1996a, Instruction 4715.3).

Caldera A large crater formed by volcanic explosion or by collapse of a volcanic cone.

Candidate Species. Any species, plant or animal, which is being considered for listing as threatened or endangered by the U.S. Department of the Interior (DoD Instruction 4715.3).

Categorical Exclusion (CATEX). Categories of actions which do not individually or cumulatively have a significant effect on the human environment and which have been found to have no such effect in procedures adopted by a Federal agency in implementation of the regulations implementing the National Environmental Policy Act (NEPA) (40 Code of Federal Regulations [CFR] 1507.3) and for which, therefore, neither an Environmental Assessment (EA) nor an Environmental Impact Statement (EIS) is required (40 CFR 1508.4).

Census Tract Area. Census tracts are small, relatively permanent statistical subdivisions of a county and are delineated for most metropolitan areas and other densely populated counties by local census statistical area committees following Census Bureau guidelines. Census tracts usually have between 2,500 and 8,000 persons and, when first delineated, are designed to be homogeneous with respect to population characteristics, economic status, and living conditions. Census tracts do not cross county boundaries.

Classified Road. Roads within the BMGR that are planned and managed for motor vehicle access including military, military/agency, military/agency/public use, and public use roads.

Conservation. Planned management, use, and protection of natural and cultural resources to provide sustainable use and continued benefit for present and future generations, and the prevention of exploitation, destruction, waste, and/or neglect (U.S. DoD 1996a, Instruction 4715.3).

Conservation Self-assessment. A multimedia inspection or evaluation of an installation's natural and cultural resources program. External conservation self-assessments are conducted by designated DoD representatives from outside the installation being inspected. Internal conservation self-assessments are usually conducted by installation personnel (DoD Instruction 4715.3).

Conservation Biology. An integrative approach to the protection and management of biodiversity that uses appropriate principles and experiences from basic biological fields such as genetics and ecology; from natural resource management fields such as fisheries and wildlife; and from social sciences such as anthropology, sociology, philosophy, and economics (TNC as reported in Leslie and others 1996).

"Cold War" Historic Resources. Buildings, structures, sites, objects, and districts built, used or associated with critical events or persons during the "Cold War" period (1945-1989) and that possess exceptional historic importance to the nation or that are outstanding examples of technological or scientific achievement (U.S. DoD 1996a, Instruction 4715.3).

Cooperating Agency. Upon the request of the lead agency, any Federal agency other than a lead agency which has jurisdiction by law or special expertise with respect to any environmental impact involved in a proposal (or a reasonable alternative) for legislation or other major Federal action significantly affecting the quality of the human environment may serve as a cooperating agency. The selection and responsibilities of a cooperating agency are described in 40 CFR 1501.6. A State or local agency of similar qualifications or, when the effects are on a reservation, an Indian Tribe, may by agreement with the lead agency become a cooperating agency (40 CFR 1508.5).

Criteria air pollutants. A group of very common air pollutants regulated by EPA on the basis of criteria on health and/or environmental effects of pollution (EPA 2002).

Critical Habitat. (A) The term "critical habitat" for a threatened or endangered species means- (i) the specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the provisions of section 4 of the Endangered Species Act (ESA), on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and (ii) specific areas outside the geographical area occupied by the species at the time it is listed in accordance with the provisions of section 4 of this Act, upon a determination by the Secretary of the Interior that such areas are essential for the conservation of the species. (B) Critical habitat may be established for those species now listed as threatened or endangered species for which no critical habitat has heretofore been established as set forth in subparagraph (A) of this paragraph. (C) Except in those circumstances determined by the Secretary, critical habitat shall not include the entire geographical area which can be occupied by the threatened or endangered species (ESA).

Cultural Resources. Buildings, structures, sites, districts, and objects that may be eligible for or that are included in the National Register of Historic Places; "cultural items" as defined in 25 United States Code (U.S.C.) 3001; American Indian, Eskimo, Aleut, or Native Hawaiian sacred sites for which access is protected under 42 U.S.C. 1996; "archeological resources" as defined by Section 470 aa-ll of 16 U.S.C.; and "archeological artifact collections and associated records" defined under 36 Code of Federal Regulations (CFR) 79 (U.S. DoD 1996a, Instruction 4715.3).

Cumulative Impact. The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable actions regardless of what agency, federal or nonfederal, or what person undertakes the action. Cumulative impacts

can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7).

Desert Pavement. Large, flat, conspicuous areas devoid of vegetation and covered by a layer of tightly packed small stones, which are frequently very dark-colored due to the development of desert varnish. Desert pavement is formed through a process of physical weathering and the accumulation of a porous mineral layer in the soil that separates and levels the desert pavement surface from the underlying, uneven rocky material.

Desert Varnish (also rock varnish). A glossy coating found on rock, stone, or boulder surfaces that provides the dark complexion of the rock surface despite the internal color of the rock. Desert varnish is very thin, at most a few hundredths of a millimeter thick (about the thickness of a sheet of paper). The thickest, darkest coatings of varnish found on older deposits may be the result of accumulation over many tens of thousands to more than 100,000 years.

Drag Road. Road that is maintained and used by the Border Patrol to reveal the foot traffic of persons illegally entering the United States from Mexico. These roads are classified as either agency use or agency/public use roads (U.S. Department of the Interior, Bureau of Land Management [BLM] 1990).

Dredged Material. Material that has been dredged from waters of the United States.

Drift. A horizontal passageway driven into or along the path of a vein or rock layer or a small tunnel connecting two larger shafts.

Drop Tank. An aerodynamically shaped fuel tank that is carried externally by an aircraft on the underside of the fuselage or wings to extend its flight range. Drop tanks can be jettisoned in an emergency to reduce the aerodynamic drag and weight of the aircraft or to eliminate explosive quantities of fuel.

Ecological Succession. The natural, sequential change of species composition of a community in a given area (TNC).

Ecoregion. Regions of relative homogeneity with respect to ecological composition, structure, and function (TNC, as reported in Leslie and others 1996).

Ecosystem. A dynamic and natural complex of living organisms interacting with each other and with their associated non1iving environment (U.S. DoD 1996a, Instruction 4715.3).

Ecosystem Integrity. The ability to support and maintain a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization

comparable to that of the natural habitat of the region (Angermeier and Karr 1994) (TNC, as reported in Leslie and others 1996).

Ecosystem Management. A goal-driven approach to managing natural and cultural resources that supports present and future mission requirements; preserves ecosystem integrity; is at a scale compatible with natural processes; is cognizant of nature's timeframes; recognizes social and economic viability within functioning ecosystems; is adaptable to complex and changing requirements; and is realized through effective partnerships among private, local, State, tribal, and Federal interests. Ecosystem management is a process that considers the environment as a complex system functioning as a whole, not as a collection of parts, and recognizes that people and their social and economic needs are a part of the whole (U.S. DoD 1996a, Instruction 4715.3).

Effects. Include: (a) Direct effects, which are caused by the action and occur at the same time and place. (b) Indirect effects, which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems. Effects and impacts, as used in this document, are synonymous. Effects include ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic, historic, cultural, economic, social, or health, whether direct, indirect, or cumulative. Effects may also include those resulting from actions which may have both beneficial and detrimental effects, even if on balance the agency believes that the effect will be beneficial (40 CFR 1508.8).

Ejido. A piece of land in Mexico with communal ownership with individual use.

Endangered Species. Any species which is in danger of extinction throughout all or a significant portion of its range other than a species of the Class Insecta determined by the Secretary of the Interior or the Secretary of Commerce to constitute a pest whose protection under the provisions of the ESA would present an overwhelming and overriding risk to man (ESA).

Endemic. Native to a certain region.

Environmental Assessment (EA). A concise public document for which a Federal agency is responsible that serves to: (1) Briefly provide sufficient evidence and analysis for determining whether to prepare an environmental impact statement or a finding of no significant impact. (2) Aid an agency’s compliance with the Act when no environmental impact statement is necessary. (3) Facilitate preparation of a statement when one is necessary. An EA shall include brief discussions of the need for the proposal, of alternatives as required by Section 102(2)(E) of

NEPA, of the environmental impacts of the proposed action and alternatives, and a listing of agencies and persons consulted (40 CFR 1508.9).

Environmental Impact Analysis Process (EIAP). The Air Force process for complying with and implementing the National Environmental Policy Act and Council on Environmental Quality implementing regulations.

Environmental Impact Statement (EIS). The "detailed statement" required by Section 102(2)(C) of the National Environmental Policy Act (NEPA) which an agency prepares when its proposed action significantly affects the quality of the human environment (40 CFR 1508.11).

Exotic Species. Species that occur in a given place, area, or region as the result of direct or indirect, deliberate or accidental introduction of the species by human activity (U.S. DoD 1996a, Instruction 4715.3).

Federal Agency. Federal agency means all agencies of the Federal Government. It does not mean the Congress, the Judiciary, or the President, including the performance of staff functions for the President in his Executive Office. It also includes, for purposes of this document, States and units of general local government and Indian tribes assuming NEPA responsibilities under Section 104(h) of the Housing and Community Development Act of 1974 (40 CFR 1508.12).

Fill Material. Any material used for the primary purpose of replacing an aquatic area with dry land or for changing the bottom elevation of a waterbody. This includes both natural materials (silt, sand, gravel, rock, and wood) and manufactured materials (concrete, plastic, steel, and treated wood).

Finding of No Significant Impact (FONSI). A public document that briefly presents the reasons why an action will not have a significant impact on the quality of the human environment and therefore will not require preparation of an environmental impact statement (40 CFR 1508.13).

Floodplain. Any land area susceptible to being inundated by water from any source. This term typically refers to the 100-year overflow area. The term 100-year flood is used to describe that there is a 1 percent estimated probability that a flood event will happen in any given year. The 100-year overflow area would be the area affected by a 100-year flood.

Fragmentation. The disruption of extensive habitats into isolated, smaller patches. Fragmentation has two negative components of biota: loss of total habitat area, and smaller, more isolated remaining habitat patches (TNC, as reported in Leslie and others 1996).

Human Environment. Interpreted comprehensively to include the natural and physical environment and the relationship of people with that environment. (See the definition of

''effects'' per 40 CFR 1508.8). This means that economic or social effects are not intended by themselves to require preparation of an environmental impact statement. When an environmental impact statement is prepared and economic or social and natural or physical environmental effects are interrelated, then the environmental impact statement will discuss all of these effects on the human environment (40 CFR 1508.14).

Inert. Unreactive, non-explosive (in regard to inert ordnance).

Intaglio A figure or design incised beneath the surface of the earth or composed of rock alignments (which are sometimes referred to as "geoglyphs").

Integrated Cultural Resources Management Plan (ICRMP). A plan that defines the process for the management of cultural resources on DoD installations (U.S. DoD 1996a, Instruction 4715.3).

Integrated Natural Resources Management Plan (INRMP). An integrated plan based, to the maximum extent practicable, on ecosystem management that shows the interrelationships of individual components of natural resources management (e.g., fish and wildlife, forestry, land management, and outdoor recreation) to mission requirements and other land use activities affecting an installation's natural resources (U.S. DoD 1996a, Instruction 4715.3).

Invasive species. A non-native (alien) species whose introduction does or is likely to cause economic or environmental harm or harm to human health (Executive Order 13112).

Invertebrate. An animal that lacks a backbone or spinal column.

Jurisdiction by Law. Jurisdiction by law means agency authority to approve, veto, or finance all or part of a proposal (40 CFR 1508.15).

Lead Agency. Lead agency means the agency or agencies preparing or having taken primary responsibility for preparing the environmental impact statement (40 CFR 1508.16).

Limits of Acceptable Change. Limits of acceptable change is a process that requires deciding what kinds of conditions are acceptable in a recreational setting then prescribing actions to protect or achieve those conditions. The objective of this system is not to prevent all change but rather to control it, and to decide what management actions are required to maintain or enhance the desired conditions. The limits of acceptable change process consists of four major components: (1) specifying acceptable and achievable resource conditions and, if desirable, social conditions, defined by a series of measurable parameters; (2) analyzing the relationships between existing conditions and those judged as acceptable; (3) identifying management actions necessary to achieve the desired conditions; and (4) a program of monitoring and evaluating management effectiveness.

Livestock. Domestic and feral animals including, but not necessarily limited to, horses, cattle, burros, sheep, and goats.

Maar Crater. A low-relief broad volcanic crater formed by shallow explosive eruptions that are usually caused by the heating and boiling of groundwater when magma invades the groundwater table (U.S. Geological Survey [USGS] 2002).

Major Federal Action. Major Federal action includes actions with effects that may be major and which are potentially subject to Federal control and responsibility. Major reinforces but does not have a meaning independent of significantly (40 CFR 1508.27). Actions include the circumstance where the responsible officials fail to act and that failure to act is reviewable by courts or administrative tribunals under the Administrative Procedure Act or other applicable law as agency action. Actions include new and continuing activities, including projects and programs entirely or partly financed, assisted, conducted, regulated, or approved by federal agencies; new or revised agency rules, regulations, plans, policies, or procedures; and legislative proposals (40 CFR 1506.8, 1508.17). Actions do not include funding assistance solely in the form of general revenue sharing funds, distributed under the State and Local Fiscal Assistance Act of 1972, 31 U.S.C. 1221 et seq., with no Federal area. Projects include actions approved by permit or other regulatory decision as well as federal and federally assisted activities (40 CFR 1508.18).

Maquilador. The twin-plant concept that uses American manufacturing plants located on both sides of the U.S./Mexico border to take advantage of favorable wage and operating differential costs.

Matter. Includes for purposes of 40 CFR 1504: (a) With respect to the Environmental Protection Agency, any proposed legislation, project, action or regulation as those terms are used in section 309(a) of the Clean Air Act (42 U.S.C. 7609). (b) With respect to all other agencies, any proposed major federal action to which section 102(2)(C) of NEPA applies (40 CFR 1508.19).

Metamorphic Rock. Any rock derived from pre-existing rocks by mineralogical, chemical, and/or structural changes, especially in the solid state, in response to marked changes in temperature, pressure, shearing stress, and chemical environment, generally at a depth in the earth's crust.

Microphytic Soil Crust (also cryptogamic or cryptobiotic soil crust). The fragile, crusty top layer of many desert soils characterized by the growth of lichens, algae, blue-green algae (cyanobacteria), liverworts, or mosses, in combination or singularly.

Military Use Road. A classified road in the BMGR road network that is needed and used to meet military mission requirements.

Military/Agency Use Road. A classified road in the BMGR road network that is needed and used to meet military mission requirements and is also used to meet specific agency requirements.

Military/Agency/Public Use Road. A classified road in the BMGR road network that is both needed and used to meet military mission or other specific agency requirements and is also used for public access.

Mitigation. Mitigation includes: (a) Avoiding the impact altogether by not taking a certain action or parts of an action. (b) Minimizing impacts by limiting the degree or magnitude of the action and its implementation. (c) Rectifying the impact by repairing, rehabilitating, or restoring the affected environment. (d) Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action. (e) Compensating for the impact by replacing or providing substitute resources or environments (40 CFR 1508.20).

Mitigation Banking. Actions taken to compensate for future adverse effects of undertakings by providing substitute resources or environments in advance of any specific undertaking (U.S. DoD 1996a, Instruction 4715.3).

Mobile sources. Moving objects that release pollution; mobile sources include cars, trucks, buses, planes, trains, motorcycles and gasoline-powered lawn mowers. Mobile sources are divided into two groups: road vehicles, which include cars, trucks and buses, and non-road vehicles, which includes trains, planes and lawn mowers (EPA 2002).

Motorized Vehicle. A vehicle designed and operated principally for highway transportation of property or passengers, but does not include a vehicle designed or used for military field training, combat, or tactical purposes (U.S. DoD 1996b, Regulation 440.36-R)

Multiple Use. The integrated, coordinated, and compatible use of natural resources so as to achieve a sustainable yield of a mix of desired goods, services, and direct and indirect benefits while protecting the primary purpose of supporting and enhancing the military mission and observing stewardship responsibilities (U.S. DoD 1996a, Instruction 4715.3).

National Environmental Policy Act (NEPA) Process. All measures necessary for compliance with the requirements of Section 2 and Title I of the National Environmental Policy Act (40 CFR 1508.21).

National Register of Historic Places. The official Federal list of sites, districts, buildings, structures, and objects worthy of preservation consideration because of significance in American history, architecture, archeology, engineering, or culture. Significance may be local, State, or national in scope. National Register eligibility criteria are published in 36 CFR 60.

National Register Resource and/or Historic Property. Any resource that meets eligibility criteria for the National Register of Historic Places, whether or not it has been formally registered, identified or acknowledged as "eligible." "Historic property" is used synonymously with "National Register resource" (U.S. DoD 1996a, Instruction 4715.3).

Native Americans. American Indians, Eskimos, Aleuts, and Native Hawaiians (U.S. DoD 1996a, Instruction 4715.3).

Native Wood. For this EIS and with regard to the use of native wood for campfires, native wood is wood from a species found on the BMGR regardless of whether that wood was collected from the BMGR or transported from an off-range location. Appendix D, Table D-1 includes a list of representative plants species that may occur on the BMGR.

Natural Resources. All elements of nature and their environments of soil, air, and water. Those consist of two general types, as follows:

- Earth Resources. Nonliving resources such as minerals and soil components.
- Biological Resources. Living resources such as plants and animals.
  (U.S. DoD 1996a, Instruction 4715.3).

Needs Assessment Survey. An inventory of an installation's inventories, management plans, personnel, training, supplies, equipment, and other management tools to identify future actions and resources needed for the installation to comply with the requirements of this Instruction (DoD Instruction 4715.3).

Nonattainment area. A geographic area in which the level of a criteria air pollutant is higher than the level allowed by the federal standards. A single geographic area may have acceptable levels of one criteria air pollutant but unacceptable levels of one or more other criteria air pollutants; thus, an area can be both attainment and nonattainment at the same time (EPA 2002).

Non-native Species. With respect to a particular ecosystem, any species, including its seeds, eggs, spores, or other biological material capable of propagating that species, that is not native to that ecosystem (Executive Order 13112).

Notice of Intent. A notice that an environmental impact statement will be prepared and considered. The notice shall briefly: (a) Describe the proposed action and possible alternatives. (b) Describe the agency's proposed scoping process including whether, when, and where any scoping meeting will be held. (c) State the name and address of a person within the agency who can answer questions about the proposed action and the environmental impact statement (40 CFR 1508.22).

Off-Road Vehicle (ORV). (a) Means a motorized vehicle when operated off of highways on land, water, snow, ice or other natural terrain or on a combination of land, water, snow, ice or

other natural terrain. (b) Includes a two-wheel, three-wheel or four-wheel vehicle, motorcycle, four-wheel drive vehicle, dune buggy, amphibious vehicle, ground effects or air cushion vehicle and any other means of land transportation deriving motive power from a source other than muscle or wind. (c) Does not include a vehicle that is either: (i) Designed primarily for travel on, over or in the water. (ii) Used in installation, inspection, maintenance, repair or related activities involving facilities for the provision of utility or railroad service (Arizona Revised Statutes [ARS], Title 28, Chapter 3, Article 20, § 28-1171).

Operational Carrying Capacity. The amount of military operations a given area can support without causing permanent environmental damage (DoD Instruction 4715.3).

Particulates or particulate matter (PM_{10}). A criteria air pollutant. Particulate matter includes dust, soot and other tiny bits of solid materials that are released into and move around in the air. Particulates are produced by many sources, including burning of diesel fuels by trucks and buses, incineration of garbage, mixing and application of fertilizers and pesticides, road construction, industrial processes such as steel making, mining operations, agricultural burning (field and slash burning), and operation of fireplaces and woodstoves. Particulate pollution can cause eye, nose and throat irritation and other health problems (EPA 2002).

Pediments. Broad, gently sloping surfaces extending from the abrupt contact of the mountains with the valley floor primarily formed by water erosion. The pediment formation is a smooth, eroded bedrock surface formed over time and often covered with a thin, discontinuous, alluvial veneer.

Physiographic Province. Physiographic provinces are very large, general landscape units that display dominant geologic formations and patterns such as basins, plateaus, and mountain ranges.

Planning Level Survey and/or Inventory of Biological, Cultural, or Earth Resources. An inventory of "sensitive and significant resources" that must be identified to integrate legal and stewardship requirements with military requirements so that defense preparedness is maintained (DoD Instruction 4715.3).

Proposal. Proposal exists at that stage in the development of an action when an agency subject to NEPA has a goal and is actively preparing to make a decision on one or more alternative means of accomplishing that goal and the effects can be meaningfully evaluated. Preparation of an environmental impact statement on a proposal should be timed (40 CFR1502.5) so that the final statement may be completed in time for the statement to be included in any recommendation or report on the proposal. A proposal may exist in fact as well as by agency declaration that one exists (40 CFR 1508.23).

Public Use Road. A classified road in the BMGR road network that is not necessary to meet military mission or other specific agency requirements and is used principally for public access.

Record of Decision (ROD). A public document signed by the agency decision-maker at the time of a decision. The ROD states the decision, alternatives considered, the environmentally preferable alternative or alternatives, factors considered in the agency's decision, mitigation measures that will be implemented, and a description of any applicable enforcement and monitoring programs.

Referring Agency. The federal agency which has referred any matter to the Council on Environmental Quality after a determination that the matter is unsatisfactory from the standpoint of public health or welfare or environmental quality (40 CFR 1508.24).

Restricted Airspace. Airspace with defined vertical and lateral dimensions that has been established by the Federal Aviation Administration (via the rule-making process) to denote areas where military activities can occur. Within restricted airspace, the flight of aircraft, while not wholly prohibited, is subject to restriction. Restricted airspace is established to contain or segregate activities that would be hazardous to other nonparticipating aircraft.

Riparian Habitat or Area. A zone of transition from the aquatic to terrestrial ecosystems, whose presence is dependent upon surface and/or subsurface water, and which reveals through its existing or potential soil/vegetation complex the influence of that water. Riparian habitat may be associated with features such as lakes; reservoirs; estuaries; potholes; springs; bogs; wet meadows; muskegs; and ephemeral, intermittent, or perennial streams. Riparian areas are often characterized by dense vegetation and an abundance and diversity of wildlife.

Riverine. Located along or in the banks of a river.

Road. A motor vehicle travelway within the BMGR. Includes both classified and unclassified roads.

Scope. Consists of the range of actions, alternatives, and impacts to be considered in an environmental impact statement. The scope of an individual statement may depend on its relationships to other statements (40 CFR 1502.20 and 1508.28). To determine the scope of environmental impact statements, agencies shall consider three types of actions, three types of alternatives, and three types of impacts. They include:

(a) Actions (other than unconnected single actions) which may be:
   (1) Connected actions, which means that they are closely related and therefore should be discussed in the same impact statement. Actions are connected if they:
      (i) Automatically trigger other actions which may require environmental impact statements.

(ii) Cannot or will not proceed unless other actions are taken previously or simultaneously.

(iii) Are interdependent parts of a larger action and depend on the larger action for their justification.

(2) Cumulative actions, which when viewed with other proposed actions have cumulatively significant impacts and should therefore be discussed in the same impact statement.

(3) Similar actions, which when viewed with other reasonably foreseeable or proposed agency actions, have similarities that provide a basis for evaluating their environmental consequences together, such as common timing or geography. An agency may wish to analyze these actions in the same impact statement. It should do so when the best way to assess adequately the combined impacts of similar actions or reasonable alternatives to such actions is to treat them in a single impact statement.

(b) Alternatives, which include:

(1) No action alternative.

(2) Other reasonable courses of actions.

(3) Mitigation measures (not in the proposed action).

(c) Impacts, which may be:

(1) direct

(2) indirect

(3) cumulative

(40 CFR 1508.25)

Sensitive Resources. "Resources" identified as "highly responsive or susceptible to modification by external agents or influences" (U.S. DoD 1996a, Instruction 4715.3).

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

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

(b) *Intensity*. This refers to the severity of impact. Responsible officials must bear in mind that more than one agency may make decisions about partial aspects of a major action. The following should be considered in evaluating intensity:

(1) Impacts that may be both beneficial and adverse. A significant effect may exist even if the Federal agency believes that on balance the effect will be beneficial.

(2) The degree to which the proposed action affects public health or safety.

(3) Unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas.

(4) The degree to which the effects on the quality of the human environment are likely to be highly controversial.
(5) The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks.
(6) The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration.
(7) Whether the action is related to other actions with individually insignificant but cumulatively significant impacts. Significance exists if it is reasonable to anticipate a cumulatively significant impact on the environment. Significance cannot be avoided by terming an action temporary or by breaking it down into small component parts.
(8) The degree to which the action may adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources.
(9) The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973.
(10) Whether the action threatens a violation of Federal, State, or local law or requirements imposed for the protection of the environment.

[43 Federal Register 56003, Nov. 29, 1978; 44 Federal Register 874, Jan. 3, 1979] (40 CFR 1508.27).

Significant Resources. "Resources" identified as "having special importance," or as "having or likely to have more influence on a particular aspect of the environment than other components" (U.S. DoD 1996a, Instruction 4715.3).

Special Expertise. Means statutory responsibility, agency mission, or related program experience (40 CFR1508.26).

State Implementation Plan (SIP). A detailed description of the programs a state will use to carry out its responsibilities under the Clean Air Act. State implementation plans are collections of the regulations used by a state to reduce air pollution. The Clean Air Act requires that EPA approve each state implementation plan. Members of the public are given opportunities to participate in review and approval of state implementation plans (EPA 2002).

Stewardship. The management of resources entrusted to one's care in a way that preserves and enhances the resources and their benefits for present and future generations (U.S. DoD 1996a, Instruction 4715.3).

Sustainable Yield. Managing a renewable natural resource to provide an annual or periodic yield of goods, services, and direct and indirect benefits, into perpetuity. That may include, but is

not limited to, maintaining economic benefits, ecological processes and functions, and biodiversity (U.S. DoD 1996a, Instruction 4715.3).

Take. In the context of species protected by the Endangered Species Act, take means harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or attempt to engage in any such conduct. (The Endangered Species Act of 1973, as amended; Section 3(18)).

Tiering. The coverage of general matters in broader environmental impact statements (such as national program or policy statements) with subsequent narrower statements or environmental analyses (such as regional or basinwide program statements or ultimately site-specific statements) incorporating by reference the general discussions and concentrating solely on the issues specific to the statement subsequently prepared. Tiering is appropriate when the sequence of statements or analyses is: (a) From a program, plan, or policy environmental impact statement to a program, plan, or policy statement or analysis of lesser scope or to a site-specific statement or analysis. (b) From an environmental impact statement on a specific action at an early stage (such as need and site selection) to a supplement (which is preferred) or a subsequent statement or analysis at a later stage (such as environmental mitigation). Tiering in such cases is appropriate when it helps the lead agency to focus on the issues which are ripe for decision and exclude from consideration issues already decided or not yet ripe (40 CFR 1508.28).

Total Dissolved Solids (TSD). Salt, or an aggregate of carbonates, bicarbonates, chlorides, sulfates, phosphates, and nitrates of calcium, magnesium, manganese, sodium, potassium, and other cations that form salts.

Tribe. A Federally recognized tribe or other Federally recognized Native American group or organization (U.S. DoD 1996a, Instruction 4715.3).

Unclassified Road. Road not intended to be part of, and not managed as part of, the BMGR transportation system; examples include temporary roads, unplanned roads, cross-country vehicle tracks, and abandoned travelways.

Undertaking. Any Federal, Federally assisted, or Federally licensed action, activity, or program, new or continuing, that may have an effect on National Register resources and thereby triggers procedural responsibilities under Section 470 et seq. of 16 U.S.C. (DoD Instruction 4715.3).

Unexploded ordnance (UXO). Refers to military munitions that have been primed, fused, armed, or otherwise prepared for action, and have been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard to operations, installation, personnel, or material and remain unexploded either by malfunction, design, or any other cause.

Unroaded Area. Any area without the presence of a classified road. This term is generally applied to areas of notable size and/or configuration.

Viewshed – The total area visible from a point (or series of points along a linear transportation facility) and conversely the area, which views the facility.

Viewpoint - A key observation point that characterizes the current visual environment.

Watershed. A drainage basin. The region drained by, or contributing water to a stream, lake, or other body of water.

Waters of the United States. The federal Clean Water Act defines this as surface waters, including streams, streambeds, rivers, lakes, reservoirs, arroyos, washes, and other ephemeral watercourses and wetlands.

Weapons Impact Scoring System (WISS). An automated television camera/computer system that detects and triangulates the locations of bomb hits within the target impact areas.

Wetlands. Lands where saturation is the dominant factor determining the nature of soil development and the types of plant and animal communities living in the soil and on its surface. Common terms used to describe various wetlands include "marshes," "bogs," "swamps," "small ponds," "sloughs," "potholes," "vernal pools," and "wet meadows" (DoD Instruction 4715.3).

Wilderness. Congressionally designated wilderness areas are described in the Wilderness Act of 1964 [Section 2(c)] as “A wilderness, in contrast with those areas where man and his own works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain. An area of wilderness is further defined to mean in the Wilderness Act an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which: (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man’s work substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; (3) has at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and (4) may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value.” (Wilderness Act of 1964, Section 2(c)).

Winze. An inclined shaft extending from one level to another in a mine.

EXECUTIVE SUMMARY

INTRODUCTION

The Barry M. Goldwater Range (BMGR) in southwestern Arizona is a major U.S. military installation encompassing 1,733,921 acres (2,709 square miles) that is used by the U.S. Air Force and U.S. Marine Corps (hereinafter Air Force and Marine Corps), and other aviation components of the U.S. Armed Forces, primarily to train military aircrews to fly air combat missions. To a lesser extent, the range is also used to support some other types of national defense purposes, most of which support or are associated with air combat training. This Environmental Impact Statement (EIS) for a proposed Integrated Natural Resources Management Plan (INRMP) for the BMGR was prepared through an interagency partnership composed of the Air Force, Marine Corps, U.S. Fish and Wildlife Service (USFWS), U.S. Bureau of Land Management (BLM), and Arizona Game and Fish Department (AGFD). These agencies formed an INRMP Core Planning Team early on in the EIS and proposed INRMP planning process to promote interagency coordination and collaboration in the development of the EIS and subsequent INRMP document.

The BMGR has been one of the nation's finest and most productive reservations for training military aircrews in aerial air-to-ground combat since 1941. Initially established on approximately 1.1 million acres but incorporating over 2.77 million acres by the close of World War II, the range varied slightly in size over the years with subsequent land withdrawals and deletions to generally encompass about 2.7 million acres until the Military Lands Withdrawal Act (MLWA) of 1999 reduced the land area of the BMGR to its current size. Although the range land area was reduced, the extent of the overlying restricted airspace available to support military aviation activities, which has a surface footprint of 2,776,720 acres, was unchanged by the MLWA of 1999. This Act also reconfirmed that national defense activities continue to be the primary land use purpose of the BMGR.

Parallel to its continuing value as an essential national defense asset, the BMGR is also nationally significant as a critical component in the largest remaining tract of relatively unfragmented Sonoran Desert in the United States that, with the exception of State Route 85, is free of major developments that may disrupt ecological connectivity. This tract currently totals about 5,000 square miles and, in addition to the BMGR, includes the adjacent, ecologically linked areas of Organ Pipe Cactus National Monument (NM), Cabeza Prieta National Wildlife Refuge (NWR), and Sonoran Desert NM and other BLM-administered lands. Within this contiguous complex, the BMGR contributes almost 55 percent of the land area and is more than twice the size of any other component.

The BMGR encompasses a dramatic landscape of rugged mountain ranges and broad alluvial valleys that have experienced only scattered settlement since late prehistoric times. The location is central in the most tropical of the three North America warm deserts, with a diverse and well-adapted assemblage of plant and animal life. The BMGR encompasses significant east to west

ecological gradients that define the interface between the Arizona Upland and Lower Colorado River Valley subdivisions of the Sonoran Desert. The eastern extent of the range harbors some of the most extensive and healthy saguaro cactus-mixed cactus-paloverde forests in the Arizona Upland Subdivision while its western extreme, 130 miles away, is within the dune fields of the Gran Desierto, which lies around the head of the Gulf of California. The BMGR incorporates much of the diversity of landforms, rainfall, and elevation gradients that are present within the Sonoran Desert in Arizona and that contribute to the biodiversity of this ecoregion.

Federally listed endangered or threatened wildlife species that are present or have the potential to be present on the BMGR include the Sonoran pronghorn, lesser long-nosed bat, and cactus ferruginous pygmy-owl. Of these, only the Sonoran pronghorn appears to be dependent upon habitats within the range for its continued survival. It is estimated that about 42 percent of the suitable terrain within the current distribution of Sonoran pronghorn is located within the BMGR. Other wildlife of special concern in Arizona present on the range includes the California leaf-nosed bat, flat-tailed horned lizard, Cowles fringe-toed lizard, and Sonoran population of desert tortoise. Peirson's milkvetch, a federally threatened plant, and the acuña cactus, a federal candidate, also occur in small isolated areas of the BMGR. Many plants protected by the Arizona Native Plant Law are present on the range, including sand food and individual crested saguaros.

PURPOSE OF AND NEED FOR THE PROPOSED INRMP

The MLWA of 1999 requires that the Secretaries of the Air Force, Navy, and Interior jointly prepare an INRMP for the BMGR[ES-1] in accordance with the Sikes Act.[ES-2] The Sikes Act in turn requires that the INRMP be cooperatively prepared by these same parties together with the head of the state fish and wildlife agency in the affected state, which, in Arizona, is the Director of the AGFD.[ES-3] As stipulated by the MLWA of 1999, the purposes of the INRMP must be to provide for the "proper management and protection of the natural and cultural resources of [the range], and for sustainable use by the public of such resources to the extent consistent with the military purposes [of the BMGR]."[ES-4]

As indicated, the MLWA of 1999 also directs that the INRMP must be prepared and implemented in accordance with the Sikes Act.[ES-5] The Sikes Act sets forth the Nation's resource management policies and guidance for U.S. military installations and requires the preparation of INRMPs for all installations with significant natural resources, including those (such as the BMGR) composed of withdrawn lands. The Sikes Act provides that the "… Secretary of Defense shall carry out a

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[ES-1] Public Law [P.L.] 106-65 §3031(b)(3)(A)
[ES-2] 16 U.S. Code (U.S.C.) 670a et seq.
[ES-3] 16 U.S.C. 670a (a)(2)
[ES-4] P.L. 106-65 §3031(b)(3)(E)(i)
[ES-5] P.L. 106-65 §3031(b)(3)(D)

program to provide for the conservation and rehabilitation of natural resources on military installations…" and that an INRMP is to be prepared to facilitate implementation of that program.[ES-6] The Sikes Act specifies that:

> Consistent with the use of military installations to ensure the preparedness of the Armed Forces, the Secretaries of the military departments shall carry out [the aforementioned program] to provide for—
>
> (A) the conservation and rehabilitation of natural resources on military installations;
> (B) the sustainable multipurpose use of the resources, which shall include hunting, fishing, trapping and non-consumptive uses; and
> (C) subject to safety requirements and military security, public access to [the BMGR] to facilitate the use.[ES-7]

This EIS was prepared to support development of the proposed INRMP for the BMGR. Five alternative strategies, including the proposed action, for managing natural and cultural resources and public access within the BMGR are addressed in this EIS. Each of these alternative management strategies represents a potential resource management program, or an INRMP, for the range. The alternative selected in the Record of Decision (ROD) for this EIS from among the range of reasonable alternatives considered in the EIS will constitute the management strategy that will form the framework for the proposed INRMP and will be implemented for the BMGR. The EIS was prepared pursuant to Section 102(2)(c) of the National Environmental Policy Act of 1969 (NEPA), as implemented by the Council on Environmental Quality regulations (40 Code of Federal Regulations 1500 to 1508), which require federal agencies to consider potential environmental concerns as early as possible in the development of proposed programs, projects, and activities.

Beyond the statutory requirements of the MLWA of 1999 and Sikes Act, development of a new management plan is also needed to address changes in current and future military mission requirements, Department of Defense (DoD) management policies, and BMGR resource and public use conditions that have changed since the most recent previous resource management plan was prepared for the range. The most recent resource management plan for the range is the Lower Gila South Resource Management Plan (RMP) Goldwater Amendment (hereinafter Goldwater Amendment) that was prepared by the BLM. The Goldwater Amendment, which was placed into effect in 1990, was prepared under the purviews of the MLWA of 1986[ES-8] and the Federal Land Policy Management Act (FLPMA) of 1976 (43 U.S.C. 1701 et seq.). The Goldwater Amendment

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[ES-6] 16 U.S.C. 670a (a)(1)(A) and (B)

[ES-7] 16 U.S.C. 670a (a)(3)

[ES-8] P.L. 99-606

is based on management planning and environmental assessments that were completed during the early to late 1980s.

The resource conservation components of the pending INRMP for the BMGR in many ways will be comparable to those developed for many other federal land management plans including existing or pending plans for the nearby Organ Pipe Cactus NM and the adjacent Cabeza Prieta NWR and BLM lands. The feature of the pending INRMP that will distinguish it most sharply from most other federal land management plans, however, is that implementation and control of the primary land use of the BMGR—which is the support of designated military purposes—is not subject to review or modification through the development of the INRMP. Decisions regarding current and future military land use at installations subject to Sikes Act planning are assessed through other processes, which may include planning under the auspices of NEPA or other applicable environmental laws, but are not reviewed through the preparation of an INRMP. Rather, land management on a military installation must be consistent with the military purposes of the installation.

In the case of the BMGR, Congress previously determined, through the MLWA of 1999, that this range would be used first and foremost for specific national defense purposes.[ES-9] Management of natural and cultural resources and public access within the BMGR must be consistent with these specified national defense purposes. The national defense mandate for the BMGR, however, does not preclude implementing a management plan that provides for effective conservation, protection, and rehabilitation of natural resources; protection of cultural resources; and opportunities for sustainable public use. Given the character of the military mission at the BMGR, there are opportunities to use, protect, and conserve resources within the range and latitude available to incorporate effective management methods.

An INRMP document will be extracted from the final EIS following the signing of the ROD. The INRMP will be based on the alternative management strategy selected in the ROD and will be used to implement that alternative. Consistent with the MLWA of 1999; the Sikes Act; and DoD, Air Force, and Marine Corps guidance for preparing INRMPs, the major features of the final INRMP will include:

- purpose, authority, and development history of the INRMP
- future review and amendment procedures for the INRMP
- location and mission of the BMGR
- a brief land use and management history of the BMGR
- current and foreseeable future military missions and land-use
- non-military agency missions and land use
- incorporation of the Integrated Cultural Resources Management Plan (ICRMP) for the BMGR by reference

[ES-9] P.L. 106-65 §3031(a)(2)

- provisions for meeting trust responsibilities and access and consultation requirements relative to affected Indian tribes
- public access opportunities and conditions
- overview of the BMGR environment
- resource management goals
- selected resource management alternative
- projects and schedule planned to implement the selected management alternative
- follow-on requirements under the NEPA, or other regulatory laws, to implement specific planned management projects

STUDY AREA AND TIME HORIZON

The area studied during preparation of the EIS for the proposed INRMP differed among the various resource elements assessed. This allowed for the adequate examination of both the local and regional factors that may influence the BMGR environment as well as those that may, in turn, be affected by the proposed management actions. The time horizon, or functional period, of the INRMP extends to 2024, when the current land withdrawal authorization is scheduled to expire. In order to provide for effective resource management over the course of the next 21 years, the BMGR INRMP must address both long- and short-term planning horizons. The Sikes Act provides that INRMPs are to be reviewed on a regular basis, but not less than every five years. This requirement reflects the fact that military activities; natural resource protection, conservation, and rehabilitation needs; and public access opportunities and patterns are likely to change over time and that there must be a mechanism for adapting an INRMP to changing conditions if the plan is to provide for effective management.

RELATIONSHIP OF THE INRMP AND ICRMP

The MLWA of 1999 directs that the INRMP for the BMGR be prepared and implemented in accordance with the Sikes Act[ES-10] and include provisions for the proper management and protection of both cultural and natural resources.[ES-11] The provision to manage both natural and cultural resources in the INRMP is not specifically supported by the Sikes Act. The scope of the Sikes Act is limited to the conservation and management of natural resources on DoD lands and does not include guidance for the management and protection of cultural resources. More than 30 individual federal laws, federal regulations, executive orders, and memoranda, federal guidelines, and military requirements provide authority and guidance for cultural resources management on DoD lands. In view of these legal instruments, DoD has implemented policies that direct the preparation of ICRMPs for all lands and waters under its control that contain cultural

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[ES-10] P.L. 106-65 Section §3031(b)(3)(D)
[ES-11] P.L. 106-65 Section §3031(b)(3)(E)(i)

resources.[ES12] DoD has, thus, adopted a dual planning and management track for natural and cultural resources under its jurisdiction. As a result, INRMPs and ICRMPs typically serve as companion documents that direct natural and cultural resources management at DoD installations.

Preparation of an ICRMP for the BMGR was under way before the MLWA of 1999 directed that the INRMP must include provisions for both natural and cultural resources management. As a consequence, the Air Force and Marine Corps have taken two steps to meet their cultural resources management responsibilities under the MLWA of 1999 and other applicable statutory and regulatory requirements. First, they decided to complete their joint effort to prepare an ICRMP for the range. Second, they determined that the proposed INRMP would adopt and support the cultural resources management goals of the ICRMP and would incorporate the protocols and procedures prescribed in the ICRMP for managing culture resources by reference. At the time of this EIS, the ICRMP is pending final adoption by the Air Force and Marine Corps. However, cultural resources management goals for the BMGR have been developed and will be incorporated in the proposed INRMP. The natural resources management goals developed through the EIS planning process for the proposed INRMP are compatible with these cultural resources management goals and also with the alternative management strategies studied in the draft EIS that would implement those natural resources management goals.

RESPONSIBILITIES TO INDIAN TRIBES

The MLWA of 1999 requires that the INRMP for the BMGR:

> be developed in consultation with affected Indian tribes and include provisions that address how the Secretary of the Navy and the Secretary of the Air Force intend to—
>
> (I) meet the trust responsibilities of the United States with respect to Indian tribes, lands, and rights reserved by treaty or Federal law affected by the withdrawal and reservation;
>
> (II) allow access to and ceremonial use of sacred sites to the extent consistent with the military purposes for which such lands are withdrawn and reserved; and
>
> (III) provide for timely consultation with affected Indian tribes.[ES-13]

Steps for consulting with Indian tribes on the development of the INRMP have been pursued in accordance with this provision of the MLWA of 1999.

[ES-12] DoD Instruction 4715.3

[ES-13] P.L. 106-65 §3031(b)(3)(E)(ii)

PUBLIC INVOLVEMENT AND ISSUES

Public scoping meetings were held in the Arizona communities of Phoenix, Tucson, Yuma, Gila Bend, Ajo, and Sells. A total of 125 public participants from several southern Arizona communities attended the meetings. More than 70 individuals provided feedback during the scoping phase. Potentially interested Native American tribes and groups throughout Arizona, as well as tribes in California and New Mexico with a stated interest in the BMGR, were given information about the proposed INRMP development process and invited to participate. The scoping meeting in Sells was on the Tohono O'odham Nation. Tribal leaders were invited to attend or send representatives to workshops and also were asked to identify other avenues, such as briefings to tribal councils or other bodies or field visits to places of interest or concern on BMGR, that would facilitate their participation in the process. Tribes were further queried by letter as to issues of concern regarding plants, animals, topographic features, water sources, or other aspects of the natural environment within the BMGR that may have cultural value for the native people of the region. These letters also invited tribes to comment on the management of these resources and identify needs for access to places of cultural importance on the BMGR.

The most frequently cited issue of concern raised during public scoping related to motorized access within the BMGR. Two public workshops were conducted after the formal scoping period had closed to obtain further public input into the continuing development of the INRMP and EIS. These workshops were attended by 62 members of the public together with 33 individuals affiliated with the INRMP Core Planning Team agencies and their consultants. The first workshop focused on whether the draft management strategies addressed a full range of reasonable alternatives. The second workshop included an interactive exercise to obtain input from the public attendees concerning public road access within the BMGR and the implications of roads within the range for resource protection, conservation, and rehabilitation.

BMGR MILITARY MISSION AND RESOURCE MANAGEMENT SETTING

Current BMGR Military Mission and Resource Management Responsibilities

BMGR lands are made available for military purposes by virtue of the MLWA of 1999 for use as (1) an armament and high-hazard testing area; (2) training for aerial gunnery, rocketry, electronic warfare, and tactical maneuvering and air support; and (3) other defense related purposes.[ES-14] The current primary mission of both BMGR—East and BMGR—West is military aircrew training. The range has been used periodically for testing and some other defense related purposes, but, since its inception, non-training activities have been secondary to the primary training mission of the BMGR. For the Air Force, Marine Corps, Navy, Air National Guard, Army National Guard, and Air Force Reserve, the BMGR is an essential component of the national defense training base that

[ES-14] P.L. 106-65 § 3031(a)(2)

is indispensable to their abilities to produce the combat-ready aircrews needed to defend the nation and its interests. As the nation's third largest military reservation, the BMGR has the training capabilities, capacities, and military air base support that provide the flexibility needed to sustain a major share of the country's aircrew training requirements now as well as into the foreseeable future. The value of the BMGR for supporting high-quality aircrew training stems from a combination of restricted land and airspace, extensive land and airspace size, ten nearby supporting air bases, electronic training instrumentation, nearby supporting military airspace, year-round flying weather, and varied natural terrain. The primacy of the aircrew training mission at the BMGR is expected to continue into the foreseeable future.

There is a beneficial relationship between the military reservation and resource conservation, which has contributed importantly to the past protection of much of the BMGR environment. In large part, the ecological health of the BMGR has been maintained or restored over the last 60 years because (1) most land uses that would be severely disruptive to the environment have been excluded from the range in order to protect the safety of the public and military personnel and to prevent disruption of the military training operations, and (2) only a small percentage of the restricted land area is disturbed by military training activities. Safety requirements restrict both habitation and economic development of the range and specify that public visitation be directly controlled. Activities such as livestock grazing; mining; agricultural crop production; and residential, commercial, or industrial development—which have caused significant ecological damage elsewhere within the BMGR region—have been legally excluded from the range since the World War II era.

As a result of the MLWA of 1999 and other enabling legal instruments, three federal agencies and one state agency—Air Force, Marine Corps, USFWS, and AGFD—currently hold primary responsibilities for managing natural resources within the BMGR. A fifth agency, BLM, has reserve oversight roles but no longer has direct resource management responsibilities. The Air Force and Marine Corps now have primary surface management responsibility for BMGR lands, and hence its natural and cultural resources. The MLWA of 1999[ES-15] directs the Secretaries of the Navy, Air Force, and Interior to jointly prepare the INRMP. Thus, the Secretary of the Interior remains involved in the management of natural, and to a lesser extent, cultural resources within the BMGR. The Sikes Act[ES-16] clarifies that the Secretary of the Interior will act through the Director of the USFWS when participating in the preparation and implementation of INRMPs. Further, USFWS responsibilities for administering compliance with the Endangered Species Act of 1973[ES17] and Migratory Bird Treaty Act of 1918[ES-18] within the BMGR are neither diminished nor expanded by the MLWA of 1999 or Sikes Act.

[ES-15] P.L. 106-65 §3031(b)(3)(A), (D), and (E)
[ES-16] 16 U.S.C. 670a (a)(2)
[ES-17] 16 U.S.C. 1531 et seq.
[ES-18] 16 U.S.C. 703 et seq.

The State of Arizona has primary jurisdiction over resident wildlife management within the BMGR, except where pre-empted by federal law. This jurisdiction is implemented on behalf of the State by the AGFD, which acts under the guidance of the Arizona Game and Fish Commission. Nothing in the MLWA of 1999 or Sikes Act either diminishes or expands the jurisdiction of the State with respect to resident wildlife management. In addition, AGFD is responsible for providing safe off-highway vehicle recreation for Arizona. The BLM serves limited roles within the BMGR under the MLWA of 1999 including: (1) consulting in the resolution of disagreements on the contents of the INRMP or its subsequent amendments, (2) resuming management of BMGR lands should resource management authority be returned to the Secretary of the Interior, (3) consulting on any non-emergency closures of the BMGR that are not specified in the forthcoming INRMP, and (4) consulting prior to using the withdrawn and reserved lands for any purposes other than specified defense-related purposes.[ES-19] The dispute resolution responsibility of the Secretary of the Interior is limited to consultation.

Safety and Security, Public Access, and BMGR Management Units

Safety hazards or security concerns are present on a near continuous basis within approximately 62 percent of the BMGR. These areas must be restricted from public access because of ongoing hazards associated with munitions delivery training, known or suspected high concentrations of unexploded ordnance on the ground surface, laser use hazards, airfield safety and security, or other safety or security requirements at training or support sites. Safety hazards or security concerns are present within the other 38 percent of the BMGR only at selected times or in selected confined locations, such as an electronic instrument site. These areas of the BMGR can generally accommodate public visitation on a regular basis as long as certain necessary restrictions regarding access to local electronic instrument, training, support, or resource protection sites are observed. Access to all areas of the range is regulated by permit at all times. Approximately 80 percent of all range areas open to public visitation are in BMGR—West. The area of BMGR—West open to general public access encompasses about 521,000 acres, which is about 75 percent of the BMGR—West land area. Public access to BMGR—East is limited to about 133,000 acres, which is almost 13 percent of the BMGR—East land area.

Seven land management units have been identified within the BMGR; three, Units 1 through 3, within BMGR—West and four, Units 4 through 7, within BMGR—East to facilitate the planning and implementation of natural and cultural resources management activities. Numbered one through seven from west to east, the surface areas of these units include:

- Management Unit 1 - approximately 230,000 acres
- Management Unit 2 - approximately 265,000 acres
- Management Unit 3 - approximately 195,000 acres

[ES-19] P.L. 106-65 §3031(b)(3)(C), §3031(b)(1)(C) and (b)(7), §3031(b)(2)(C), and §3031(a)(5)

- Management Unit 4 - approximately 280,000 acres
- Management Unit 5 - approximately 440,000 acres
- Management Unit 6 - approximately 138,000 acres
- Management Unit 7 - approximately 188,000 acres

Planning and Management Philosophy

The DoD approach to integrated resource management planning and the application of ecosystem management concepts are central to the proposed INRMP. Ecosystem management incorporates the concepts of biological diversity and ecological integrity in a process that considers the environment as a complex system functioning as a whole, not merely as a collection of parts, and recognizes that people and their social and economic needs are a part of the whole. In its application, a goal-driven approach is used to manage natural and cultural resources in a manner that supports present and future mission requirements; preserves ecosystem integrity; is at a scale compatible with natural processes; is cognizant of nature's timeframes; recognizes social and economic viability within functioning ecosystems; is adaptable to complex and changing requirements; and is realized through effective partnerships among private, local, state, tribal, and federal interests. Because ecosystem management is based on an emerging understanding of ecology, biological diversity, and resources management, and because ecosystems are open, changing, and complex systems, this planning and management philosophy requires flexibility. Provisions to allow for adaptive management include monitoring, assessment, reassessment, and adjustment as necessary.

DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

This EIS addresses five alternative strategies, including the proposed action and no-action alternative, for managing natural and cultural resources and public access within the BMGR. The five alternative management strategies were developed in accordance with NEPA. The management strategy framework for the BMGR will be chosen after a rigorous analysis has identified and assessed the potential environmental impacts of reasonable alternatives for managing the resources of the range in comparative form. Selection of reasonable management alternatives for the proposed INRMP was guided by criteria that included statutory and regulatory guidance and BMGR resource management goals developed during the EIS-based planning process. The resource management goals were developed in view of applicable statutory and regulatory guidance; the needs of the military mission of the range; public and tribal viewpoints gathered through scoping, workshops, and other avenues of participation; and input regarding the management missions and needs of the USFWS, AGFD, and U.S. Border Patrol. (The U.S. border Patrol has a critical law-enforcement mission on the BMGR related to international border security, control of illegal immigration, and life-saving rescue of immigrants stranded in the desert of the range.) In accordance with the MLWA of 1999 and Sikes Act, the minimum qualifying

requirements of each resource management alternative studied in the development of the EIS for the proposed INRMP are to (1) support the use of the BMGR to ensure the preparedness of the armed forces, (2) provide for proper management and protection of its natural and cultural resources (which is to include natural resource conservation and rehabilitation), and (3) provide for sustainable multipurpose public access and use of the range consistent with the requirements of its military purposes. Alternatives that were inconsistent with these overall requirements were eliminated from detailed study.

In accordance with these overall parameters, four alternative management strategies were developed during the public scoping and workshop phases of the EIS planning process for the proposed INRMP. These four strategies, identified as A through D, were designed to represent the relative range of management requirements and issues identified during these early planning phases. Each alternative outlines resource management guidance for 17 separate management elements. Following the scoping and workshop phases, a proposed management strategy for the long-term management of natural and cultural resources within the BMGR (which hereinafter is referred to as the proposed action and is not identified by a letter) was identified. This proposed action combines various management elements from each of the initial four management strategies to form a fifth, separate, composite management alternative. Although additional composite variations in the management prescriptions defined by the initial four alternative management strategies could be developed, the alternatives presented represent the relative range of actions that are both needed for the BMGR and are appropriate to the special statutory guidance that governs resource management on military installations.

Resource management goals were developed on both a policy and resource-specific basis. As an initial step in the INRMP planning process, the Core Planning Team developed five overarching policy goals that are non-resource specific and are in support of and consistent with the military mission; conservation, rehabilitation, and protection of natural and cultural resources; and sustainable public access. In no implied order of importance, the five management policy goals include:

1. Maintain and enhance the natural resources to ensure that these resources are sustained in a healthy condition for compatible uses (for example, low-impact recreation) by future generations, while supporting the existing and future military purposes of the BMGR.

2. Manage cultural resources in accordance with the BMGR Integrated Cultural Resources Management Plan.

3. Allow for public access to BMGR resources for sustainable multipurpose use, consistent with the military purposes of the range (including security and safety requirements) and ecosystem sustainability.

4. Apply ecosystem management principles through a goal- and objective-driven approach that recognizes social and economic values; is adaptable to complex, changing requirements; and is realized through effective partnerships among private, local, state, tribal, and federal interests.

5. Meet or exceed the statutory requirements of the MLWA of 1999, Sikes Act, and other applicable resource management regulatory requirements.

The resource-specific goals address earth, water, vegetation, wildlife, and visual resources; transportation; recreation; Native American access; non-military and perimeter land use; and special natural/interest areas. Each of the resource-specific management goals are consistent with the over arching policy goals. Resource-specific management goals for the range are shown in Table S-1.

TABLE S-1
RESOURCE-SPECIFIC MANAGEMENT GOALS

Resource Management Category	Management Goal(s)
Earth Resources	▪ Implement best management practices to control and prevent excessive soil erosion, implement soil conservation measures, and restore or rehabilitate degraded landscapes wherever practicable, subject to budgetary constraints.
Water Resources	▪ Manage water resources to protect, maintain, and improve water quality; to conserve water to prevent lowering of the water table levels; and to ensure compliance with regulatory requirements while maintaining unrestricted access for military purposes.
Vegetation Resources	▪ Protect and conserve plant communities and species diversity. ▪ Identify, protect, conserve, manage, and comply with regulatory requirements for threatened and endangered plant species or otherwise important or sensitive plant species. ▪ Inventory the range for occurrence and distribution of exotic plant species and implement management measures for their removal or control. ▪ Restore or rehabilitate altered or degraded plant communities wherever practicable, subject to budgetary constraints. ▪ Incorporate the principles of ecosystem management and promote biodiversity.
Wildlife Resources	▪ Protect and conserve wildlife habitat, species diversity, and viable populations. ▪ Identify, protect, conserve, manage, and comply with regulatory requirements for federally threatened and endangered wildlife species or otherwise significant or sensitive species. ▪ Restore or rehabilitate human-altered or degraded wildlife habitats wherever practicable, subject to budgetary constraints. ▪ Incorporate the principles of ecosystem management and promote biodiversity. ▪ Control trespass livestock.
Visual Resources	▪ Protect or enhance the integrity and diversity of visual resources (including scenic qualities of the landscape) on the BMGR.
Transportation	▪ Develop a BMGR transportation plan that addresses continued land-based access to the BMGR for military training and testing; provides access for wildlife research and wildlife habitat management, land management, and law enforcement by federal and state agencies; and provides access for wildlife-oriented recreation and sustainable multipurpose use by the public. ▪ Establish policies and provide procedures that ensure that the use of vehicles on the BMGR will be controlled and directed so as to protect resources, promote safety, and minimize conflicts among the various uses of the BMGR.

TABLE S-1
RESOURCE-SPECIFIC MANAGEMENT GOALS

Resource Management Category	Management Goal(s)
Recreation	▪ Provide for public access and use of natural resources/BMGR lands for sustainable multi-purposes when such activities are compatible with mission activities and other considerations such as security, safety, and resource sensitivity. ▪ Assess the continuing applicability of Special Recreation Management Area (SRMA) designations in consideration of their incompatibility with military operations. ▪ Manage all activities in accordance with the ICRMP for the BMGR.
Native American Access	▪ Provide for Native American access to Traditional Cultural Places and sacred sites, consistent with the military mission and natural resource management goals.
Non-Military Land Use	▪ Develop a program for addressing rights-of-way on the BMGR. ▪ Participate in local initiatives to advance ecoregional planning and biodiversity goals.
Perimeter Land Use	▪ Cooperate with land managers of adjoining property for conservation, public relations, and compliance benefits. ▪ Develop strategies, in coordination with ranchers when feasible, to reduce trespass livestock occurrences.
Special Natural/Interest Areas	▪ Recognize and review existing special resource management areas, such as Areas of Critical Environmental Concern (ACECs) and the backcountry byway, and assess the continuing applicability of special management provisions for the protection of these areas.

Each of the alternative management strategies for the proposed INRMP was developed in context of the policy and resource-specific goals. Each of these strategies addresses 17 resource management elements, as shown in Table S-2.

TABLE S-2
PROPOSED INRMP RESOURCE MANAGEMENT ELEMENTS

1.	Resource Inventory and Monitoring
2.	Special Natural/Interest Areas
3.	Motorized Access and Unroaded Area Management
4.	Camping and Visitor Stay Limits
5.	Recreation Services and Use Supervision
6.	Rockhounding
7.	Wood Cutting, Gathering, and Firewood Use, and Collection of Native Plants
8.	Hunting
9.	Recreational Shooting
10.	Utility/Transportation Corridors
11.	General Vegetation, Wildlife, Wildlife Habitat, and Wildlife Waters
12.	Special Status Species
13.	Soil and Water Resources
14.	Air Resources
15.	Visual Resources
16.	Wildfire Management
17.	Perimeter Land Use, Encroachment, and Regional Planning

Alternative Management Strategy A (No-action Alternative)

Alternative Management Strategy A, the no-action alternative, would continue the ongoing management practices of the Goldwater Amendment. The scope of the Goldwater Amendment established overall natural and cultural resource management direction for the range and prescribed that a series of component subplans be prepared including habitat management plans (HMPs) and a transportation plan. An HMP titled *Lechuguilla-Mohawk Habitat Management Plan and Environmental Assessment* was finalized in 1997and partially implemented for BMGR—West. A draft HMP titled *Draft Barry M. Goldwater East Habitat Management Plan and Environmental Assessment* has been developed, but has not been finalized or implemented for BMGR—East. Development of the transportation plan included an extensive multiple-year inventory of roads within the BMGR but did not reach the actual plan preparation stage because Congress passed the MLWA of 1999 two years earlier than anticipated, effectively cutting the BLM's management tenure short.

The Goldwater Amendment and HMPs would be adopted and continued through the proposed INRMP under Alternative Management Strategy A. This alternative is reasonable as it is required by NEPA as the no-action alternative and it is consistent with the MLWA of 1999, which supports incorporating existing plans in the proposed INRMP. The existing plans are also compatible with the military mission of the BMGR, provide measures for resource protection and conservation, and support public use that is both compatible with the military mission and the prescribed resource protection and conservation measures. Some components of the existing plans, which were prepared pursuant to the FLPMA, would need to be modified before they could be implemented under the Sikes Act. One example is that three ACECs, two SRMAs, and a Backcountry Byway that were designated under the Goldwater Amendment, but have since expired, would have to be redesignated as special natural/interest areas under the Sikes Act.

Existing wildlife management practices would continue under Alternative Management Strategy A and there would be no defined shift in emphasis toward ecosystem management methods. Strategy A would include the construction of up to two new waters (seven were planned, five have been constructed) plus the repair, redesign, and/or redevelopment of three existing wildlife waters within BMGR—West and the development of 15 new waters and the repair, redesign, and/or redevelopment of 13 existing waters within BMGR—East.

Existing public access and recreation opportunities would be retained under Alternative Management Strategy A, which would keep the entire existing road network within the range (consisting of 2,222 miles of inventoried roads) open for vehicular use; the public would continue to have access to that portion of the network that is currently open to public use (Table S-3). A total of 973 miles, or 44 percent, of the existing BMGR roads are currently available for general public access, with 79 percent (767 miles) of these roads located within BMGR—West.

TABLE S-3
MILES AND AREA OF ROADS WITHIN THE BMGR UNDER THE PROPOSED ACTION AND EACH ALTERNATIVE MANAGEMENT STRATEGY

Access Status of Roads for Government and Public Access	No-Action Alternative (Alternative Management Strategy A)	Alternative Management Strategy B	Proposed Action (Alternative Management Strategy C)	Alternative Management Strategy D
1. Miles of road within BMGR—West restricted military use areas that are not open to general public access	189	189	134	124
2. Miles of road within BMGR—East restricted military use areas that are not open to general public access	985	985	734	719
3. Total miles of roads in BMGR restricted areas (Lines 1+2)	**1,174**	**1,174**	**868**	**843**
4. Miles of road within BMGR—West outside of restricted areas but restricted to government use only	63	70	63	48
5. Miles of road within BMGR—East outside of restricted areas but restricted to government use only	12	12	12	12
6. Total miles of roads in BMGR outside of restricted areas but restricted to government use only (Lines 4+5)	**75**	**82**	**75**	**60**
7. Miles of BMGR—West roads outside of restricted military use areas that are generally open to public access [1]	767	767	447	383
8. Miles of BMGR—East roads outside of restricted military use areas that are generally open to public access [1]	206	206	174	171
9. Total miles of BMGR roads outside of restricted military use areas that are generally open to public access[1] (Lines 7+8)	**973**	**973**	**621**	**554**
10. Total miles of roads in BMGR—West of all types (Lines 1+4+7)	**1,019**	**1,026**	**643**	**555**
11. Total miles of roads in BMGR— East of all types (Lines 2+5+8)	**1,203**	**1,203**	**920**	**902**
12. Total miles of BMGR roads of all types (Lines 3+6+9)	**2,222**	**2,229**	**1,564**	**1,457**
Approximate surface area (acres) of all BMGR roads based on a 30-foot road width [2]	**8,080**	**8,105**	**5,687**	**5,298**

[1] Roads are subject to future temporary or permanent closures for safety, security, or resource protection purposes.
[2] Widths of improved and unimproved roadways vary on the BMGR from 6 to 60 feet; 30 feet is a conservative width index that represents a potential upper limit of the aggregate area occupied by roads and associated shoulder areas.

A determination of the number of existing unroaded areas with surface areas in 20 various size categories from 1 to 120,000+ acres, including 3,000 acres or less and 3,001 acres or more as one of the category dividing points, was performed through a geographic information system (GIS) analysis. A 50-foot buffer was added to each side of the roads to represent the distance that vehicles currently may be pulled off of the road for parking. Excluded in the analysis of unroaded

areas were 172,700 acres of established military vehicle-use areas and other developed military use areas. The GIS analysis results show that under Alternative Management Strategy A, the existing condition, there are 526 areas of 3,000 acres or less within the BMGR and 121 existing unroaded areas of 3,001 acres or more. Given the existing road network, the largest unroaded area is about 95,000 acres located in BMGR—East.

Alternative Management Strategy A would allow for the construction of the Yuma Area Service Highway (ASH) in the northwest corner of BMGR—West as currently proposed by the Arizona Department of Transportation and being analyzed in separate NEPA documentation.

Proposed Action and Preferred Alternative

The proposed action, which is also the preferred alternative, is a composite of 17 resource management elements borrowed from Alternative Management Strategies A, B, C, and D (Table S-4). On overall balance, the proposed action is weighted toward resource management elements selected from Alternative Management Strategies C and D. The weighting of the proposed action shows the Core Planning Team's decision to select a blend of resource management elements that would support continued public access and recreation opportunities within the BMGR while also affording increased emphasis on resource conservation, rehabilitation, and protection.

TABLE S-4
PROPOSED ACTION
SELECTED RESOURCE MANAGEMENT STRATEGY ELEMENTS

	Resource Management Element	Selected Resource Management Strategy							
		Range-wide Application	Management Unit Application						
			Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7
1	Resource Inventory and Monitoring	D							
2	Special Natural/Interest Areas	C							
3	Motorized Access and Unroaded Area Management	C							
4	Camping and Visitor Stay Limits	C							
5	Recreation Services and Use Supervision		D	C	D	D	D	D	D
6	Rockhounding		D	C	C	D	D	D	D
7	Wood Cutting, Gathering, and Firewood Use, and Collection of Native Plants		D	C	C	C	C	C	C
8	Hunting	B							
9	Recreational Shooting	C							
10	Utility/Transportation Corridors	C							
11	General Vegetation, Wildlife, Wildlife Habitat, and Wildlife Waters	C							
12	Special Status Species	C							
13	Soil and Water Resources	D							
14	Air Resources	A							
15	Visual Resources	B							
16	Wildfire Management	B							
17	Perimeter Land Use, Encroachment, and Regional Planning	D							

The differences between the proposed action and the existing conditions under Alternative Management Strategy A, the no-action alternative are summarized in Table S-5.

TABLE S-5
PROPOSED ACTION RESOURCE MANAGEMENT ELEMENTS COMPARED TO THE EXISTING CONDITION

Resource Inventory and Monitoring

- The extent and intensity of resource monitoring and survey would increase (new action).
- Additional vegetation and wildlife surveys, in particular, would be conducted to monitor the ecosystem health and biodiversity (new action).
- Limits of acceptable change monitoring would be used to track key indicators of environmental impacts resulting from recreation use. Adaptive responses, based on monitoring results, would redirect management measures as necessary to ensure that resource conservation, rehabilitation, and protection goals are met and that recreation use continues to be sustainable (new action).

Special Natural/Interest Areas

- The Flat-tailed Horned Lizard Habitat Management Area and the three previously designated ACECs would be redesignated as special natural/interest areas (no change).
- The two SRMAs and El Camino del Diablo Backcountry Byway would not be redesignated (new action).
- Special geological, scenic, cultural, or other resource areas could be evaluated in the future to determine the appropriateness of establishing additional special natural/interest areas as conservation, rehabilitation, or protection tools (new action).

Motorized Access and Unroaded Area Management

- Of the 2,222 miles of roads within the BMGR, approximately 30 percent (658 miles) would be closed under the proposed action (new action). Of these 658 miles, approximately 352 miles would be closed in areas of the BMGR that are generally accessible for public use, reducing the extent of public use roads from 973 miles to 621 miles. The other 306 miles of road to be closed are roads that are currently available for use only by the military or other agencies, resulting in 868 miles remaining from the 1,174 miles of road currently available for government use only. Approximately 91 percent (or 320 miles of the 767 miles currently available) of the reduction in available general public access road mileage would occur in BMGR—West. In BMGR—East, 32 of the 206 miles of road currently available for general public access would be closed. Most of the roads that would be closed are redundant; that is, other nearby roads provide access to the same area. However, some roads that would be closed would reduce access within localized areas.
- Site-specific planning would begin for two bypass roads (totaling approximately 7 miles) to reroute primarily Border Patrol traffic around rather than through the Cabeza Prieta NWR/Wilderness. These roads would be for government use only (new action).
- In some areas, closed roads may be actively restored to remediate a degraded ecological process or to enhance wildlife usage. Other closed roads would be allowed to revegetate naturally (new action).
- Unroaded areas of 3,000 acres or more would be conserved to the extent that such conservation is compatible with military or agency missions (new action). Assuming that the roads closed under the proposed action are revegetated over the long term, the range-wide elimination of 658 miles of road would reduce the number of unroaded areas in the BMGR of 3,000 acres or less by 67 percent from 526 to 171. In addition, there would be 44 fewer unroaded areas of 3,001 acres or more with the proposed action because smaller areas would be combined into larger blocks of unroaded areas. The largest unroaded area would be slightly more than 102,000 acres located within BMGR—East.

Camping and Visitor Stay Limits

- Dispersed, self-contained camping (non-vehicle based) would continue to be allowed in all areas open to the public (no change).
- Vehicle-based camping would continue to be allowed along most roads designated as open to public use (no change), although some road segments and specific areas would be closed to protect resources that are sensitive to human-induced disturbances (new action). Vehicles would continue to be allowed to pull up to 50 feet off the road, although campsites could be located farther from the road (no change).
- An assessment would be completed to determine the appropriateness of establishing designated camping areas (new action).
- Vehicle-based camping stays would continue to be limited to 14 consecutive days within a 28-day period except by special use permit (no change).

TABLE S-5
PROPOSED ACTION RESOURCE MANAGEMENT ELEMENTS COMPARED TO THE EXISTING CONDITION

- Rules would be prescribed to ensure that the disposal of human sewage and solid waste is in accordance with applicable federal, state, and local regulations (new action).

Recreation Services and Use Supervision

- Public off-road vehicle travel and also on- and off-road racing would continue to be prohibited (no change).
- Motorized public travel in washes would be prohibited except where the wash is a designated part of the road system open to the public and is dry (no change).
- In most areas (except Management Unit 2), a special use permit would be required for any single party with 10 or more vehicles. In Management Unit 2, a special use permit would be required for any single party with 20 or more vehicles (new action).
- All vehicles and operators would continue to be required to comply with general vehicle operating rules, including being licensed for highway driving under Arizona laws and regulations (no change).
- Visitors would continue to need a permit to access the BMGR (no change).
- New public education and recreation use programs would be developed and implemented to inform the public about road restrictions and resource sensitivities (new action).
- A minimum of six law enforcement officers would be retained and dedicated to the BMGR (new action).
- The effects of recreation use on natural and cultural resources would be monitored. If damage occurs that exceeds pre-determined limits of acceptable change, management actions would be taken to reduce and/or remediate the damage (new action).
- Signs, gates, and fences would be installed based on a needs assessment. Roads that are open to public use would be marked as open (new action). If a road does not have a sign that indicates that it is open, drivers would have to consider it closed (new action).
- Recreation use records and statistics would be developed and maintained (new action).
- Recreational use of metal detectors and entry to mines would be prohibited (new action).

Rockhounding

- Rockhounding for personal use (removing up to 25 pounds of rock) would be allowed in portions of BMGR—West (Management Units 2 and 3) except within special natural/interest areas and other designated areas where resources are sensitive to human-induced disturbances. Rockhounding would be prohibited in other parts of the BMGR (new action).

Wood Cutting, Gathering, and Firewood Use, and Collection of Native Plants

- The use of dead and downed wood for campfires would continue to be allowed in most areas that are open to the public (that is, in Management Units 2, 3, and 6). Wood cutting, gathering, and native wood campfires would be prohibited in Management Unit 1 (which includes most of the former Tinajas Altas Mountains ACEC). If wood supplies become depleted in high-use areas, additional restrictions could be implemented (new action).
- Wood cutting and wood gathering for purposes other than campfires would be prohibited throughout the range. Removal of wood from the range would also be prohibited (no change).
- Collection or salvage of native plants would continue to be prohibited in accordance with the Arizona Native Plant Law (no change). Collection of native plants would be allowed for protected Native American purposes (new action).

Hunting

- Existing game management programs would continue (no change).
- An assessment would be conducted to determine if it would be appropriate to establish a special hunting permit program that requires payment of a nominal fee to be used for the protection, conservation, and management of wildlife, including habitat improvement (new action).
- The effects of non-game species collection on wildlife, habitat, and other resources would be evaluated and, if warranted, such collection would be limited or restricted within the authority of state law (new action).

Recreational (Target) Shooting

- Recreational shooting would continue to be allowed under existing regulations as long as it is compatible with military use, public safety, and no significant resource issues are identified (no change).
- A special use permit would be required to shoot between sunset and sunrise or to use automatic weapons (new action).
- An assessment would be conducted on the appropriateness of recreational shooting on the BMGR, including the potential for designating specific shooting areas (new action).

TABLE S-5 PROPOSED ACTION RESOURCE MANAGEMENT ELEMENTS COMPARED TO THE EXISTING CONDITION
Utility/Transportation Corridors
• Construction of the Yuma ASH within a right-of-way that passes through the northwestern corner of BMGR—West would be allowed (no change). • Non-military utilities would continue to be restricted to the established utility corridor along State Route 85 and the Tucson Cornelia and Gila Bend Railroad (no change).
General Vegetation, Wildlife, Wildlife Habitat, and Wildlife Waters
• Procedures would be developed to control all trespass grazing by livestock (new action). • Actions would be taken to prevent, control, and eradicate the spread of invasive species commensurate with the threats these species pose to natural resources (new action). • Restrictions on activities would be implemented in key areas if needed to protect and conserve habitat, ecosystems, or biodiversity (new action). • Areas damaged by a discontinued military, agency, or extensive public use would be restored (new action). • New wildlife water developments would be limited to six high-priority developments in the first five years of the INRMP. Concurrently, an assessment of the beneficial and adverse effects of water developments would be conducted and used to determine whether the programs should be continued or permanently suspended on the BMGR (new action).
Special Status Species
• Surveys for special status species would be conducted on an as-needed basis and used to update lists of species that occur on the BMGR as well as species distribution and abundance (no change). • Habitat improvements would be made in support of endangered species recovery plans (no change). • Resources would be provided, as necessary, for predator control to protect a special status species (new action).
Soil and Water Resources
• Measures would be taken to continue to prevent soil erosion, water pollution, and groundwater depletion (no change). • A range-wide soil survey using Natural Resource Conservation Service standards would be conducted to provide information on soil types, erosion risks, and soil vulnerability to disturbances (new action). • Vehicular and construction activities would be restricted when soils are susceptible to a heightened risk of erosion, and areas of excessive surface damage from past activities would be restored (new action).
Air Resources
• Actions would continue to be taken to control fugitive dust at construction sites and to prevent non-point source air pollution (no change).
Visual Resources
• The effects of new actions on visual resources would continue to be considered with a focus on minimizing degradation of scenic views (no change).
Wildfire Management
• A range-wide fire management plan would be prepared to establish fire prevention and suppression protocols to minimize threats to human life, property, and natural and cultural resources (new action).
Perimeter Land Use, Encroachment, and Regional Planning
• Actions would be taken to improve coordination and communication with off-range managers and authorities to address issues of a regional concern and to provide input so that off-range actions result in few, if any, adverse effects on the BMGR (new action).

Alternative Management Strategy B

In contrast to the other alternatives, Management Strategy B would support the greatest degree of motorized access to the BMGR, including potentially expanding the road network available for public use. Strategy B provisions would still have to remain compatible with the military mission and the maintenance of a functioning natural ecosystem. For example, Strategy B would allow for

driving in designated dry washes and vehicle-based camping within 100 feet (rather than the current 50 feet required under Strategies A, C, and D and the proposed action) of public use roads. It would also potentially allow for the establishment of designated off-road vehicle use areas and public entry to designated mines. However, all motorized access and recreation use would have to remain compatible with the military mission and the maintenance of a functioning natural ecosystem. Strategy B would keep the entire existing road network open for vehicular use. Strategy B would also allow for the potential development of additional roads on a case-by-case basis, but the only identified proposed difference between the Alternative Management Strategies A and B road networks is that Strategy B would authorize planning for the two new Cabeza Prieta NWR/Wilderness bypass roads totaling approximately 7 miles. Unroaded areas and unroaded area management would be the same as described for Strategy A, with the exception of areas bisected by these bypass roads and any future roads.

Alternative Management Strategy B would provide for the application of resource protection and conservation measures, but its focus would be on resource-specific monitoring, targeted wildlife management actions (such as continued development and maintenance of wildlife waters), and basic compliance with regulatory requirements. In most other ways, Strategy B is similar to Strategy A, the no-action alternative. The key remaining difference is that Strategy B would allow the existing special management area designations for ACECs, SRMAs, and the Camino del Diablo Backcountry byway to expire in favor of managing these areas in the same manner as other BMGR locations.

Alternative Management Strategy C

Alternative Management Strategy C is similar to the proposed action because many of the resource management elements of Strategy C, including those for the range road network and wildlife management, were incorporated in the proposed action (see Table S-4). Strategy C represents all of the public access and recreation management elements of the proposed action except that Strategy C would: (1) set the single party vehicle limit without a special use permit at 19 vehicles range-wide compared to the proposed action, which would set this limit at 9 vehicles in Management Units 1, 3, 4, 5, 6, and 7, and 19 vehicles in Management Unit 2; (2) permit recreational rockhounding where the range is open to public access, whereas the proposed action would limit this activity to Management Units 2 and 3; and (3) permit the use of dead and downed wood for campfires throughout the range, whereas the proposed action would prohibit this activity in Management Unit 1. Strategy C would also promote the use of dust palliatives to control fugitive dust, while the proposed action would use best management practices to control non-point source pollution and the use of dust palliatives would be optional. Visual resource management criteria would be established and applied to new projects on the BMGR, whereas under the proposed action visual resource impacts of new projects would be limited to NEPA-based requirements.

Alternative Management Strategy D

Alternative Management Strategy D represents the opposite end of the spectrum from Strategies A and B by proposing the most limits on motorized access and public use activities, no Cabeza Prieta NWR/Wilderness bypass roads, conservation of unroaded blocks of land of 3,000 acres or more, and the greatest emphasis on adaptive management methods that incorporate feedback from ecosystem monitoring. The development of new permanent wildlife waters would be immediately suspended under this strategy pending the outcome of a detailed review of the beneficial and adverse effects of water developments on the BMGR. New permanent waters may be developed in the future if the results of this review indicate that beneficial effects outweigh adverse outcomes. Maintenance and repair of existing waters would continue pending the findings of the review.

Alternative Management Strategy D would reduce the total inventory of active roads by 765 miles to 1,457 miles, which would be about 34 percent less than the existing network (see Table S-3). Under Strategy D, 554 miles of roads would be available for general public access, which is about 43 percent less than that available under existing conditions with most of the reduction occurring in BMGR—West. There would be little difference in the effects of Alternative Management Strategy D and the proposed action on the road mileage available for general public access in BMGR—East. Strategy D would close 35 miles of public access roads in BMGR—East compared to 32 miles under the proposed action. This strategy would not allow for the proposed construction of the Yuma ASH.

With revegetation of closed roadbeds occurring over time, the number of unroaded areas in the BMGR of 3,000 acres or less would be reduced from 526 to 145 by Strategy D, a reduction of about 72 percent. Under Strategy D, there would be eight unroaded areas of more than 50,000 acres, with the largest unroaded area consisting of about 102,000 acres in BMGR—East.

ENVIRONMENTAL ANALYSIS

The existing environment of the BMGR and area of potential effect outside the BMGR was described so that the effects of the INRMP alternatives could be assessed for their effect on the environment. The discussion of each resource or management issue (Chapter 4) includes a description of the existing conditions; the relationship of the resource or management issue to the military mission; current regulatory and statutory requirements and management plans and actions that are applicable to the resource or management issue; and management information not currently available for resource management, where applicable. A total of 20 resource impact assessment categories were addressed including: earth resources, water resources, climate and air resources, vegetation, wildlife and wildlife habitat, protected species, wildfire management, grounds maintenance, public utility and transportation corridors, special management areas, outdoor recreation, public health and safety, law enforcement, transboundary and domestic

perimeter land use, cultural resources, visual resources, hazardous materials and waste, socioeconomics, noise, and environmental justice.

Comparison of the Alternatives

The potential environmental consequences of implementing the proposed management action, alternative management actions (Strategies B, C, and D), and no-action alternative (Strategy A) were compared to the baseline environmental conditions and to each other (Chapter 5). Table S-6 compares the predicted individual aggregate effects of the proposed action and Alternative Management Strategies A, B, C, and D on each of the 20 resource impact assessment categories evaluated. Table S-7 provides a summary of these aggregate effects in terms of the overall beneficial or adverse impacts the proposed action and each alternative would have on each resource impact assessment category.

In general, the aggregate effects of the proposed action and Alternative Management Strategies C and D would be beneficial for the natural and cultural resources of the range and provide mixed effects for outdoor recreation. All three of these alternatives provide for public access, but each strikes a balance between access and resource protection and conservation goals that favors the protection and conservation side of this management equation. The effects of these three alternatives on recreation are mixed because of the widely varying expectations that different groups of people have regarding desirable recreational experiences. Alternative Management Strategies A and B would be generally protective of range resources but would not offer the degree of road network management, public use controls, wildlife and habitat management provisions, and ecosystem and land use monitoring necessary to achieve the levels of natural and cultural resource protection, conservation, and rehabilitation that would be provided by the proposed action or Alternative Management Strategies C or D. Alternative Management Strategies A and B would be more supportive of public motorized vehicle access than the proposed action or Alternative Management Strategies C or D. Both considered as a whole and in consideration of specific effects on the environment, none of the alternatives were found to have significant adverse impacts on any resource and no mitigation measures[ES-20] were identified as appropriate for the proposed action, the no-action alternative (Management Strategy A), or Alternative Management Strategies B, C, or D.

Alternative Management Strategy D offers the most potential ecosystem management benefits at natural community and range-wide ecosystem scales. This alternative would also be expected to benefit most individual species through its focus on conserving wildlife habitat. The restriction proposed by this alternative on wildlife water developments for the first five-year period of the INRMP could, however, adversely limit opportunities to benefit both specific target species and a broad range of non-targets species through carefully placed and developed waters. While most effects on the human community are mixed, this strategy also offers the greatest benefits in terms

[ES-20] As defined in 40 Code of Federal Regulations 1508.20 and 46 Federal Register 18026-18038.

TABLE S-6
COMPARISON OF ALTERNATIVES

Proposed Action	Strategy A	Strategy B	Strategy C	Strategy D
Earth Resources				
Proposed Action	**Strategy A**	**Strategy B**	**Strategy C**	**Strategy D**
• Restricts or limits some uses that can cause physical disturbance and associated soil erosion (e.g., ORV travel, motorized public access, vehicle-based camping, utility/transportation corridor development), which would generally reduce physical soil impacts compared to current conditions at low levels range wide, with greater levels of improvement possible in localized areas. Includes reduced effects to soils from road network and associated uses (e.g., vehicle-based camping) by closing 658 miles of roads. The estimated upper limit of the total BMGR surface area occupied by roads and shoulder areas would be reduced from 0.47 percent to 0.33 percent.	• Some of the same impacts as the proposed action, but cumulative physical disturbance to soils would likely be slightly greater because of fewer restrictions or limitations on some uses that can disturb soils and cause accelerated rates of erosion (e.g., ORV travel, motorized public access, vehicle-based camping, utility/transportation corridor development). Includes continued effects to soils from the existing 2,222-mile road network and associated uses in short term. Future development of a transportation plan could decrease physical disturbance from roads and shoulder areas by an unquantified amount in long term.	• Some of the same impacts as the proposed action, but cumulative physical disturbance to soils would potentially be greater because of fewer restrictions or limitations on some uses (e.g., ORV travel, motorized public access, vehicle-based camping, utility/transportation corridor development) and potential for new uses that can disturb soils and cause accelerated rates of erosion (e.g., designated ORV use areas, vehicle-based camping within 100 feet instead of 50 feet of open roads). Includes continued effects to soils from an estimated 2,229-mile road network (includes 7-mile Cabeza Prieta NWR bypass roads) and associated uses and potentially by new roads. The estimated upper limit of the total BMGR surface area occupied by roads and shoulder areas would continue to be about 0.47 percent to the total range acreage.	• Differs minimally from the proposed action in terms of restrictions or limitations on uses that could cause physical disturbance and associated soil erosion. As with the proposed action, includes reduced effects to soils from road network and associated uses (e.g., vehicle-based camping) by closing 658 miles of roads. The estimated upper limit of the total BMGR surface area occupied by roads and shoulder areas would be reduced from 0.47 percent to 0.33 percent.	• Proposes greater restrictions/limitations on some uses (e.g., motorized public access, utility/transportation corridor development) and would result in slightly less physical disturbance on a range-wide basis than proposed action, correlating to slightly lower intensity effects on soil resources. Includes reduced effects to soils from road network and associated uses by closing about 765 miles of road. The estimated upper limit of the total BMGR surface area occupied by roads would be reduced from 0.47 percent to 0.31 percent.
• Limits of acceptable change monitoring would provide data needed to trigger adaptive management responses that could benefit soil resources (e.g., to curtail illicit off-road driving)	• No monitoring-related soil resources management	• Monitoring limited to compliance actions, with fewer benefits to soil resources expected than with the proposed action	• Limits of acceptable change monitoring would provide data needed to trigger adaptive management responses that could benefit soil resources (e.g., to curtail illicit off-road driving)	• Limits of acceptable change monitoring would provide data needed to trigger adaptive management responses that could benefit soil resources (e.g., to curtail illicit off-road driving)
• Continues existing earth resources management objectives, *plus* implements new management objectives for soil and water resources management that would provide better information to be used in management	• Retains existing earth resources management provisions, which includes fewer earth resources management objectives than the proposed action	• Focuses on complying with statutory requirements and preventing erosion in areas of cultural resource sensitivity, a lower level of management of earth resources than the proposed action	• Similar to the proposed action, but slightly less comprehensive monitoring and perimeter land use coordination than with the proposed action and slightly higher management standards for air and visual resources would potentially have minor mixed effects on earth resources	• Similar to the proposed action, but with higher management standards for air resources and visual resources that could indirectly lessen indirect effects on earth resources to a minor degree
• Includes a range-wide soil survey	• Does not include a range-wide soil survey	• Does not include a range-wide soil survey	• Does not include a range-wide soil survey	• Includes a range-wide soil survey
• Areas of excessive surface damage would be restored where feasible and prudent, reducing effects to soils in affected areas	• No prescribed restoration efforts	• No prescribed restoration efforts	• No prescribed restoration efforts	• Closed roads and areas of excessive surface damage would be restored where feasible, reducing effects on soils in localized areas
Water Resources				
Proposed Action	**Strategy A**	**Strategy B**	**Strategy C**	**Strategy D**
• Reductions in physical surface disturbance (as described under earth resources for this strategy) would potentially decrease associated effects to water resources, such as disruption of natural stormwater runoff patterns and increased sediment in water courses	• Slightly higher levels of physical surface disturbance than under the proposed action (as described under earth resources for this strategy) would potentially result in greater effects to water resources, such as disruption of natural stormwater runoff patterns and increased sediment in water courses. Future development of a transportation plan could lead to reductions in road-related surface disturbance of an unquantified amount.	• Slightly higher levels of cumulative physical surface disturbance than under the proposed action (as described under earth resources for this strategy) would likely result in slightly greater effects to water resources, such as disruption of natural stormwater runoff patterns and increased sediment in water courses	• Reductions in physical disturbance (as described under earth resources for this strategy) would potentially decrease any associated effects to water resources, such as disruption of natural stormwater runoff patterns and increased sediment in water courses	• Reductions in physical disturbance as described under earth resources for this strategy) would potentially decrease any associated effects to water resources, such as disruption of natural stormwater runoff patterns and increased sediment in water courses
• Additional resource inventory and monitoring objectives and a shift to adaptive management with regard to all resource management objectives could potentially identify and lessen impacts to water resources	• Continued management under existing guidance and fewer resource inventory and monitoring objectives would have less potential for reducing impacts to water resources than the proposed action	• Less extensive inventory and monitoring and soil and water resources management programs would have less potential for reducing impacts to water resources than the proposed action	• Similar to the proposed action, but excludes ecosystem-wide efforts for resource inventory and monitoring and includes air and visual resource objectives that could indirectly lessen impacts on water resources	• Same level of resource inventory and monitoring as proposed action, but includes higher management standards for air resources and visual resources that could indirectly lessen impacts on water resources
Climate and Air Resources				
Proposed Action	**Strategy A**	**Strategy B**	**Strategy C**	**Strategy D**
• Not expected to have any measurable or long-term impact on range-wide air quality	• Not expected to have any measurable or long-term impact on range-wide air quality	• Not expected to have any measurable or long-term impact on range-wide air quality	• Not expected to have any measurable or long-term impact on range-wide air quality	• Not expected to have any measurable or long-term impact on range-wide air quality
• Proposed changes in vehicular use and other activities that may influence air quality, including continuing existing management objectives for air resources management, would potentially have minor, short-term and localized, mixed effects on air resources	• Future development of a transportation plan and continued limitations or restrictions on other activities that may influence air quality, including continuing existing management objectives for air resources, would potentially have minor, short-term and localized, mixed effects on air resources	• Less restrictive measures on vehicle use and recreational activities (including potential designation of ORV use areas) and no special management objectives to avoid air quality degradation could have greater impacts on short-term and localized air quality than proposed action	• Mixed effects to air quality similar to the proposed action, but potential use of dust palliatives on heavily traveled roads could result in greater localized reductions in fugitive dust emissions	• Mixed effects to air quality similar to the proposed action, but potential use of dust palliatives on heavily traveled roads could result in greater localized reductions in fugitive dust emissions

TABLE S-6
COMPARISON OF ALTERNATIVES

General Vegetation				
Proposed Action	**Strategy A**	**Strategy B**	**Strategy C**	**Strategy D**
• Continued and new limitations or restrictions on motorized access, visitor camping, and public use would generally reduce low-level, dispersed impacts to vegetation range-wide, with greater reductions possible in some localized areas. Includes: ▪ 658 miles of road closures (resulting in a 1,564-mile total road network), which would not only result in reduced impacts from the roads, but also other associated activities; the majority of road closures (550 miles) would be within the creosotebush-bursage desertscrub natural community ▪ continuing to prohibit visitor off-road driving, retaining a minimum of six law enforcement personnel, and increased user education ▪ restrictions on camping and visitor stay limits (including decreased vehicle-based camping locations as a result of road closures and restrictions in areas with sensitive resources), rockhounding, recreational shooting, wood cutting and gathering, native wood campfires in Unit 1, collection of native plants, and further possible restrictions based on assessments of special hunting program, non-game species collection, recreational shooting, and designated camping areas	• Continuing the current limitations or restrictions on motorized access, visitor camping, and public use would not change the existing potential for low-level, dispersed impacts to vegetation at low levels range-wide or more intense impacts in some localized areas. Includes: ▪ keeping entire 2,222-mile road network open to vehicle use and associated activities ▪ continuing to prohibit visitor off-road driving, not requiring a minimum number of law enforcement personnel, and providing user education ▪ restrictions on camping and visitor stay limits, rockhounding, wood cutting and gathering (the continued prohibition of use and collection of dead and downed wood within the expired ACECs and within 150 feet of the expired Backcountry Byway), and collection of native plants	• Continuing the current limitations or restrictions on motorized access, visitor camping, and public use would not reduce the existing potential for low-level, dispersed impacts to vegetation range-wide or more intense impacts in some localized areas. Includes: ▪ retaining entire 2,222-mile road network open to existing vehicle use and associated activities ▪ continuing to prohibit off-road driving, requiring a minimum of two law enforcement personnel, and providing user education ▪ restrictions on camping and visitor stay limits, rockhounding, wood cutting and gathering (the continued prohibition of use and collection of dead and downed wood within the expired ACECs and within 150 feet of the Backcountry Byway), and collection of native plants • Potential for some increased impacts to vegetation as compared to the proposed action and existing conditions from retaining current 2,222-mile road network, plus potentially the 7-mile Cabeza Prieta NWR bypass roads and other new public use roads, and extending vehicle use to designated washes	• Continued and new vegetation based on limitations or restrictions on motorized access, visitor camping, and public use would generally reduce the level or extent of human-induced impacts low-level, dispersed impacts to vegetation range-wide, with greater levels of reduction possible in some localized areas. Includes: ▪ 658 miles of road closures (resulting in a 1,564-mile total road network), which would not only result in reduced impacts from the roads, but also other associated activities; the majority of road closures (550 miles) would be within the creosotebush-bursage desertscrub natural community ▪ continuing to prohibit visitor off-road driving, requiring a minimum of four law enforcement personnel, and increased user education ▪ restrictions on camping and visitor stay limits (including decreased vehicle-based camping from road closures and restrictions in areas with sensitive resources), rockhounding, recreational shooting, wood cutting and gathering, collection of native plants, and further possible restrictions based on assessments of special hunting program, non-game species collection, recreational shooting, and designated camping areas	• Continued and new limitations or restrictions on motorized access, visitor camping, and public use would generally reduce low-level, dispersed impacts to vegetation range-wide, with greater levels of reduction possible in some localized areas. Includes: ▪ 765 miles of road closures (resulting in a 1,457-mile total road network), mostly within the creosotebush-bursage desertscrub natural community, wherein an estimated 630 miles of road would be closed, which would not only result in reduced impacts from the roads, but also other associated activities ▪ recreation services and use supervision, including continuing to prohibit visitor off-road driving, requiring a minimum of six law enforcement personnel, and increased user education ▪ restrictions on camping and visitor stay limits (including decreased vehicle-based camping from road closures and restrictions in areas with sensitive resources), collection of native plants, and further possible restrictions based on assessments of special hunting program, and designated camping areas ▪ prohibiting rockhounding, recreational shooting, all wood cutting and gathering and native wood campfires, and non-game species collection (within the authority of state law)
• If general recreational shooting and/or camping areas were established, there may be more intense localized impacts to vegetation, but less dispersed impacts from these activities	• Effects on vegetation from recreational shooting/camping would continue to be dispersed as there would be no evaluation of establishing designated areas for these activities	• If designated camping areas were established, there may be more localized impacts to vegetation, but less dispersed impacts from camping; if a designated ORV use area were established, there could be localized destruction of vegetation	• If designated shooting and/or camping areas were established, there may be more intense localized impacts to vegetation, but less dispersed impacts from these activities	• If designated camping areas were established, there may be more intense localized impacts to vegetation, but less dispersed impacts from these activities
• General vegetative resources would be considered in a broader, regional context, and a more adaptive, ecosystem management approach would be taken towards stewardship, including improved coordination with other land owners/managers; maintenance of existing, or establishment of additional special management provisions for protection of vegetation; and increased monitoring, surveying and mapping efforts to provide reliable and up-to-date scientific information about vegetative resources and their response to ongoing military and civilian use on the BMGR and within the greater ecoregion. Redesignation of HMA and ACECs may promote enhanced protection of vegetation communities within these special natural/interest areas.	• Management of vegetative resources would be limited to the actions prescribed in the Goldwater Amendment, HMPs, or compliance-related requirements. Redesignation of all special management areas and applicable management provisions may promote enhanced protection of vegetation communities within areas.	• Management of vegetative resources would be somewhat expanded from existing programs to include means to monitor compliance action, invasive species management programs, and the restoration of areas damaged by discontinued use. Enhanced protection of vegetation communities associated with special natural/interest area designation would be limited to that associated with the HMA.	• Management of vegetative resources similar to the proposed action, but includes less coordination with other land owners/managers and additional visual and air resources management objectives that would have minor indirect mixed effects on vegetation management as compared to the proposed action. Redesignation of HMA and ACECs may promote enhanced protection of vegetation communities within these special natural/interest areas.	• General vegetative resources would be considered in the broadest, regional context, and a most adaptive, ecosystem management approach would be taken towards stewardship of the alternatives considered. Redesignation of all special management areas may promote enhanced protection of vegetation communities within an expanded aggregate area of special natural/interest areas.
• Unroaded areas greater than 3,000 acres would be conserved as compatible with military or agency missions, precluding or reducing impacts to plants and natural communities in these areas	• Unroaded areas would exist, but does not include an objective for unroaded area conservation	• Unroaded areas would exist, but does not include an objective for unroaded area conservation	• Unroaded areas greater than 3,000 acres would be conserved as compatible with military and agency missions, precluding or reducing impacts to plants and natural communities in these areas	• Unroaded areas greater than 3,000 acres would be conserved as compatible with military and agency missions, precluding or reducing impacts to plants and natural communities in these areas
• No augmented restoration of closed roads proposed, but vegetation restoration efforts would be implemented in areas that have been damaged by a discontinued military, agency, or intensive public use	• No roads proposed for closure in short term; no prescribed restoration	• No roads proposed for closure, vegetation restoration efforts would be implemented for areas that have been damaged by a discontinued military, agency, or intensive public use	• No augmented restoration of closed roads proposed, but vegetation restoration efforts would be implemented for areas that have been damaged by discontinued military, agency, or intensive public use	• Implementation of augmented restoration/remediation of closed roads (where feasible) and vegetation restoration efforts for areas that have been damaged by a discontinued military, agency, or intensive public use

TABLE S-6
COMPARISON OF ALTERNATIVES

General Wildlife and Wildlife Habitats				
Proposed Action	**Strategy A**	**Strategy B**	**Strategy C**	**Strategy D**
• Continued and new limitations or restrictions on motorized access, visitor camping, and public use would generally reduce low-level, dispersed impacts on general wildlife and wildlife habitat range-wide, with greater reductions possible in some localized areas. Additionally: ▪ prohibiting recreational entry to mines would protect roosting bats from disturbance ▪ minor direct effects, such as injury or disturbance, to wildlife species from vehicle use, noise, camping, and wood collection would be reduced, particularly for valley bottom-dwelling and foraging species, as roads and associated activities would be most limited/reduced in these areas ▪ potential elimination of non-game species collection could reduce impacts on the target species and collateral damage to non-target species	• Continuing the current limitations or restrictions on motorized access, visitor camping, and public use would leave the existing potential for low-level dispersed impacts on general wildlife and wildlife habitats unchanged. Additionally: ▪ continuing to prohibit recreational entry to mines would protect roosting bats from disturbance ▪ wildlife species would continue to be subject to existing minor levels of harm and/or disturbance from vehicle use, noise, camping, and wood collection ▪ no assessments called for that might add to or change use limitations or restrictions on non-game species collection	• Continuing the current limitations on restrictions on public/government motorized access would leave the existing potential for low-level dispersed impacts on general wildlife and wildlife habitats unchanged. Additionally: ▪ the evaluation of the feasibility for allowing public entry to mines could potentially impact bats, if such entry were approved ▪ wildlife would continue to be subject to at least existing levels of minor harm and/or disturbance from vehicle use, noise, camping, wood cutting and collection; levels of harm could potentially increase if the public access road network is expanded	• Continued and new limitations on public/government motorized access and recreation use would generally reduce low-level, dispersed impacts on general wildlife and wildlife habitat range-wide, but higher levels of impacts may occur from concentrated use in some localized areas. Additionally: ▪ prohibiting recreational entry to mines would protect roosting bats from disturbance ▪ minor direct effects, such as injury or disturbance, to wildlife species from vehicle use, noise, camping, and wood collection, may be reduced, particularly for valley bottom-dwelling and foraging species as roads and associated activities would be most limited/reduced in these areas ▪ change in types or intensity of impacts could result from the evaluation of non-game species collection and any restrictions (within the authority of state law)	• Continued and new limitations on public/government motorized access would generally reduce low-level, dispersed impacts on general wildlife and wildlife habitat range-wide, but higher levels if impacts may occur from concentrated use in some localized areas. Additionally: ▪ prohibiting recreational entry to mines would protect roosting bats from disturbance ▪ minor direct effects, such as injury or disturbance to wildlife species from vehicle use, noise, camping, and wood collection may be reduced to a slightly greater degree than with the proposed action, particularly for valley bottom-dwelling and foraging species as roads and associated activities would be most limited/reduced in these areas ▪ minor effects that could be reduced or eliminated through the prohibition of recreational shooting, rockhounding, and non-game species collection (within the authority of state law)
• If designated recreational shooting and/or camping areas were established, there may be more intense localized impacts to wildlife and wildlife habitat, but less dispersed impacts from these activities	• Effects on wildlife and wildlife habitat from recreational shooting/camping would continue to be dispersed as there would be no evaluation of establishing designated areas for these activities	• If designated camping areas were established, there may be more intense localized impacts to wildlife and wildlife habitat, but less dispersed impacts from camping • If a designated ORV use area were established, there could be localized destruction of wildlife habitat and injury/death of individual animals	• If designated shooting and/or camping areas were established, there may be more intense localized impacts to wildlife and wildlife habitat, but less dispersed impacts from these activities	• If designated camping areas were established, there may be more intense localized impacts to wildlife and wildlife habitat, but less dispersed impacts from these activities
• The shift toward ecosystem management approaches, as described for General Vegetation for this strategy, may result in management based on a broader range of wildlife species, including the species conservation elements that are intended to serve as indicators of biodiversity and ecosystem health	• Continued management based largely on special status and game species programs would not include an increased emphasis on ecosystem management principals and biodiversity conservation, as compared to the proposed action	• Management based largely on compliance requirements would be largely limited to special status species programs, rather than overall ecosystem management principals and biodiversity conservation, as with the proposed action	• The shift toward ecosystem management approaches, as described for General Vegetation for this strategy, may result in management based on a broader range of wildlife species, including the species conservation elements that are intended to serve as indicators of biodiversity and ecosystem health	• The shift toward ecosystem management approaches, as described for General Vegetation for this strategy, may result in management based on a broader range of wildlife species, including the species conservation elements that are intended to serve as indicators of biodiversity and ecosystem health
• The approach to wildlife water developments would limit new developments in the first five years of the INRMP to six high-priority waters (of the 17 developments proposed in the HMPs and not yet implemented, 14 are primarily for the benefit of desert bighorn sheep, two are primarily for the benefit of mule deer, and one is primarily for the benefit of Sonoran pronghorn); concurrently, literature research and studies would be conducted to further understand the beneficial and adverse effects of wildlife water developments; future management of wildlife waters would be dependent upon findings	• Up to 17 new wildlife waters could be developed during the term of the INRMP, but it is unlikely that more than six would be developed during the first five years of the INRMP; thus, during the near term, the difference between this strategy in the proposed action is that literature review and studies (called for under the proposed action) would not be conducted	• More than 17 new wildlife waters could be developed during the term of the INRMP, but it is unlikely that more than six would be developed during the first five years of the INRMP; thus, during the near term, the difference between this strategy in the proposed action is that the literature review and studies called for under the proposed action) would not be conducted	• The approach to wildlife water developments would be the same as the proposed action; wildlife water developments would be limited to six high-priority waters during the first five years of the INRMP; concurrently, literature research and studies would be conducted to further understand the beneficial and adverse effects of wildlife water developments; future management of wildlife waters would be dependent upon findings	• New wildlife water developments would be suspended for the first five years of the INRMP and, during that time period, literature research and studies would be conductedon the beneficial and adverse effects of wildlife water developments; future management of wildlife waters would be dependent upon findings
• Conservation of unroaded areas would preclude or reduce impacts to resident and transient wildlife in these areas	• There would be no objective for conservation of unroaded areas	• There would be no objective for conservation of unroaded areas	• Conservation of unroaded areas would potentially preclude or reduce impacts to resident and transient wildlife in these areas	• Conservation of unroaded areas would potentially preclude or reduce impacts to resident and transient wildlife in these areas
• No augmented restoration of closed roads proposed, but wildlife habitat restoration efforts would be implemented for areas that have been damaged by a discontinued military, agency, or intensive public use	• No roads proposed for closure in short term; no prescribed restoration	• No roads proposed for closure, vegetation restoration efforts would be implemented for areas that have been damaged by a discontinued military, agency, or intensive public use	• No augmented restoration of closed roads proposed, but wildlife habitat restoration efforts would be implemented for areas that have been damaged by a discontinued military, agency, or intensive public use	• Implementation of augmented restoration/remediation of closed roads (where feasible) and wildlife habitat restoration efforts for areas that have been damaged by a discontinued military, agency, or intensive public use

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COMPARISON OF ALTERNATIVES

Protected Species				
Proposed Action	**Strategy A**	**Strategy B**	**Strategy C**	**Strategy D**
• Continued and new limitations on motorized access, visitor camping, and public use would generally reduce the potential for low-level, dispersed impacts on protected/special status animal or plant species and, for wildlife habitat; potential extent of these reductions would vary depending on the distribution of the individual species relative to the specific areas affected by the proposed road closures or other access limitations	• Continuing the current limitations on motorized access, visitor camping, and public use would leave the existing potentials for low-level dispersed impacts on protected/special status species unchanged	• Continuing the current limitations on motorized access, visitor camping, and public use would leave the existing potentials for low-level dispersed impacts on protected/special status species unchanged	• Continued and new limitations on motorized access, visitor camping, and public use would generally reduce the potential for low-level, dispersed impacts on protected/special status animal or plant species and, for wildlife habitat; potential extent of these reductions would vary depending on the distribution of the individual species relative to the specific areas affected by the proposed road closures or other access limitations	• Continued and new limitations on motorized access, visitor camping, and public use would generally reduce the potential for low-level, dispersed impacts on protected/special status animal or plant species and, for wildlife habitat; potential extent of these reductions would vary depending on the distribution of the individual species relative to the specific areas affected by the proposed road closures or other access limitations
• The application of ecosystem management principals would favor conservation of BMGR natural communities in which protected/special status species are components and upon which they depend for survival	• Protected/special status species management would not be augmented by an increased emphasis on ecosystem management principals or transboundary management coordination	• Protected/special status species management would not be augmented by an increased emphasis on ecosystem management principals or transboundary management coordination	• The application of ecosystem management principals would favor conservation of BMGR natural communities in which protected/special status species are components and upon which they depend for survival	• The application of ecosystem management principals would favor conservation of BMGR natural communities in which protected/special status species are components and upon which they depend for survival
• Improved transboundary coordination with land managers/owners outside the BMGR would facilitate ecoregional management efforts and enhance protected/special status species management			• Improved transboundary coordination with land managers/owners outside the BMGR would facilitate ecoregional management efforts and enhance protected/special status species management	• Improved transboundary coordination with land managers/owners outside the BMGR would facilitate ecoregional management efforts and enhance protected/special status species management
• An estimated 125 miles of roads within the current active range of the Sonoran pronghorn would be closed, which is consistent with the current Marine Corps and Air Force biological opinions for Sonoran pronghorn	• No road closures proposed within the current active range of the Sonoran pronghorn, which is inconsistent with the current Marine Corps and Air Force biological opinions and would leave the potential for vehicle use to affect these animals or their habitat unchanged	• No road closures proposed within the current active range of the Sonoran pronghorn, which is inconsistent with the current Marine Corps and Air Force biological opinions and would leave the potential for vehicle use to affect these animals or their habitat unchanged	• An estimated 125 miles of roads within the current active range of the Sonoran pronghorn would be closed, which is consistent with the current Marine Corps and Air Force biological opinions for Sonoran pronghorn	• An estimated 174 miles of roads within the current active range of the Sonoran pronghorn would be closed, which is consistent with the current Marine Corps and Air Force biological opinions for Sonoran pronghorn
• An estimated 67 miles of roads within flat-tailed horned lizard habitat would be closed which would reduce the potential for these animals to be killed by vehicle use	• No road closures within flat-tailed horned lizard habitat would have potential for these animals to be killed by vehicle use unchanged	• No road closures proposed within flat-tailed horned lizard habitat would have potential for these animals to be killed by vehicle use unchanged	• An estimated 67 miles of roads within flat-tailed horned lizard habitat would be closed, which would reduce the potential for these animals to be killed by vehicle use	• An estimated 69 miles of roads within flat-tailed horned lizard habitat would be closed, which would reduce the potential for these animals to be killed by vehicle use
• Continuing to prohibit recreational entry to mines would continue to protect California leaf-nosed and lesser long-nosed bats from disturbance	• Continuing to prohibit recreational entry to mines would continue to protect lesser long-nosed and California long-nosed bats from disturbance	• Continuing to prohibit recreational entry to mines would continue to protect lesser long-nosed and California leaf-nosed bats from disturbance; potential impacts to these species from public use of mine shafts could occur if sanctioned in the future, although sites would be evaluated for compatibility with public entry	• Continuing to prohibit recreational entry to mines would continue to protect California leaf-nosed and lesser long-nosed bats from disturbance	• Continued prohibited entry to mines would continue to protect California leaf-nosed and lesser long-nosed bats from disturbance
• Implementing site-specific actions (e.g., designating camping or recreational shooting areas, creating the Cabeza Prieta NWR bypass road, etc.) could have potential impacts on protected species, which would be evaluated and mitigated as appropriate in site-specific NEPA evaluation/ Endangered Species Act compliance	• Implementing site-specific actions could have potential impacts on protected/special status species, which would be evaluated and mitigated as appropriate in site-specific NEPA evaluation/ Endangered Species Act compliance	• Implementing site-specific actions (e.g., creating the Cabeza Prieta NWR bypass road, etc.) could have potential impacts on protected/special status species, which would be evaluated and mitigated as appropriate in site-specific NEPA evaluation/ Endangered Species Act compliance	• Implementing site-specific actions (e.g., designating camping or recreational shooting areas, creating the Cabeza Prieta NWR bypass road, etc.) could have potential impacts on protected/special status species, which would be evaluated and mitigated as appropriate in site-specific NEPA evaluation/ Endangered Species Act compliance	• Implementing site-specific actions (e.g., designating camping areas) could have potential impacts on protected/special status species, which would be evaluated and mitigated as appropriate in site-specific NEPA evaluation/ Endangered Species Act compliance
Wildfire Management				
Proposed Action	**Strategy A**	**Strategy B**	**Strategy C**	**Strategy D**
• Increased surveys/studies, plans, and coordination would provide up-to-date information about ecological conditions that could be used in wildfire management planning	• Fewer studies, evaluations, and actions than proposed action, resulting in less information for wildfire management	• Fewer studies, evaluations, and actions for understanding ecological conditions than the proposed action, but includes vegetation surveys, which would be useful for wildfire management	• Slightly fewer resource monitoring activities than the proposed action, but would provide improved information on vegetation community conditions, which would be useful for wildfire management planning	• Increased surveys/studies, plans, and coordination would provide up-to-date information about ecological conditions that could be used in wildfire management planning
• Development of a wildfire management plan would facilitate fire hazard management	• No prescribed wildfire management plan	• Wildfire management plan would facilitate fire hazard management	• Development of a wildfire management plan would facilitate fire hazard management	• Development of a wildfire management plan would improve interagency coordination and facilitate fire hazard management

Wildfire Management (continued)				
Proposed Action	**Strategy A**	**Strategy B**	**Strategy C**	**Strategy D**
• Wildfire prevention would be enhanced by management activities that decrease invasive plant proliferation; provide the highest minimum law enforcement positions (six), which increases patrol activities with the associated potential to detect fire hazards; and emphasize transboundary land management/ownership coordination, which could reduce fire hazards	• Continues existing wildfire management focus on the suppression of wildfires with the lowest acreage loss and in the most cost-efficient manner	• Provides for minimal perimeter land use coordination and minimum of two law enforcement positions, potentially reducing opportunities to prevent wildfire compared to proposed action	• Wildfire prevention would be somewhat enhanced by management activities that would decrease invasive plant proliferation; provide a minimum of four law enforcement positions, which would increase patrol activities with the associated potential to detect fire hazards; and increase emphasis on transboundary land management/ownership coordination, which could reduce fire hazards	• Wildfire prevention would be enhanced by management activities that decrease invasive plant proliferation; provide the highest minimum law enforcement positions (six), which increases patrol activities with the associated potential to detect fire hazards; and emphasize transboundary land management/ownership coordination which could reduce fire hazards
Grounds Maintenance				
Proposed Action	**Strategy A**	**Strategy B**	**Strategy C**	**Strategy D**
• Could potentially change grounds maintenance procedures as a result of implementing a fire management plan, developing invasive species control procedures, determining that a change is needed to reduce impacts on sensitive biological resource (such as pest management activities affecting flat-tailed horned lizards)	• Could potentially change grounds maintenance procedures if pest management activities were determined to be affecting the flat-tailed horned lizards, another sensitive species; lack of monitoring could mean potential problem areas would not be identified	• Could potentially change grounds maintenance procedures as a result of implementing a fire management plan, developing invasive species control procedures, determining that a change is needed to reduce impact on sensitive biological resource (such as pest management activities affecting flat-tailed horned lizards)	• Could potentially change grounds maintenance procedures as a result of implementing a fire management plan, developing invasive species control procedures, determining that a change is needed to reduce impact on sensitive biological resource (such as pest management activities affecting flat-tailed horned lizards)	• Could potentially change grounds maintenance procedures as a result of implementing a fire management plan, developing invasive species control procedures, determining that a change is needed to control impact on sensitive biological resource (such as pest management activities affecting flat-tailed horned lizards)
Public Utilities and Transportation Corridors				
Proposed Action	**Strategy A**	**Strategy B**	**Strategy C**	**Strategy D**
• Allows development of Yuma Area Service Highway, but no other new corridors • Future transportation projects would be restricted to the existing State Route 85 corridor or the Yuma Area Service Highway corridor, if constructed • Restricts future utility projects to the existing State Route 85 corridor	• Requires field review and/or environmental assessments for corridor proposals (would likely allow development of Yuma Area Service Highway) • Restricts future utility projects to the existing State Route 85 corridor	• Provides for consideration of new utility/transportation corridors on a case-by-case basis, if compatible with military mission (would likely allow development of Yuma Area Service Highway) • Does not restrict future utility projects to the existing State Route 85 corridor, but requires regulatory review prior to approval	• Allows development of Yuma Area Service Highway, but no other new corridors • Future transportation projects would be restricted to the existing State Route 85 corridor or the Yuma Area Service Highway corridor, if constructed • Restricts future utility projects to the existing State Route 85 corridor	• Allows development of Yuma Area Service Highway, but no other new corridors • Future transportation projects would be restricted to the existing State Route 85 corridor or the Yuma Area Service Highway corridor, if constructed • Restricts future utility projects to the existing State Route 85 corridor
Special Management Areas				
Proposed Action	**Strategy A**	**Strategy B**	**Strategy C**	**Strategy D**
• Redesignates ACECs and HMA as special natural/interest areas, but allows the SRMAs and Backcountry Byway to expire • Existing management provisions would be retained for the HMA; management of the redesignated ACECs as special natural/interest areas and the former SRMAs and Backcountry Byway would be affected by other 16 resource management elements. Additional management provisions could be implemented for the redesig-nated special natural/interest areas. The potential for altering existing or establishing additional special natural/interest areas would be evaluated.	• Redesignates existing designations for ACECs, HMA, SRMAs, and the Backcountry Byway as special natural/interest areas • Existing management provisions would be retained for all existing special management areas	• Redesignates HMA as a special natural/interest area, but allows ACECs, SRMAs, and Backcountry Byway to expire • Existing management provisions would be retained for the HMA; management of the former ACECs, SRMAs, and Backcountry Byway would be affected by other 16 resource management elements. No prescribed evaluation of altering existing or establishing additional special natural/interest areas.	• Redesignates ACECs and HMA as special natural/interest areas, but allows the SRMAs and Backcountry Byway to expire • Existing management provisions would be retained for the HMA; management of the redesignated ACECs as special natural/interest areas and former SRMAs and Backcountry Byway would be affected by other 16 resource management elements. Additional management provisions could be implemented for the redesig-nated special natural/interest areas. The potential for altering existing or establishing additional special natural/interest areas would be evaluated.	• Redesignates ACECs, HMA, SRMAs, and Backcountry Byway as special natural/interest areas • Existing management provisions would be retained for the HMA; management of the other redesignated special natural/interest areas would be affected by other 16 resource management elements. Additional management provisions could be implemented for the redesignated special natural/interest areas. The potential for altering existing or establishing additional special natural/interest areas would be evaluated.
• Key changes in existing management of special management areas and effects thereof include: ▪ allowing use of dead and downed wood in some portions of redesignated ACECs and within 150 feet of the former Backcountry Byway where this activity is currently prohibited, which could affect wildlife and wildlife habitat in these areas ▪ 32 percent reduction of road networks within redesignated ACEC special natural/interest areas, which would reduce impacts from vehicles and vehicle-associated activities and over time would rehabilitate larger unroaded areas	• Existing management of special management areas and effects thereof would continue, including: ▪ Existing prohibition on collecting dead and downed wood for campfire use in the ACECs and within 150 feet of the Backcountry Byway ▪ Retaining existing road network and low-level dispersed impacts associated with vehicle use of these roads and other connected activities such as vehicle-based camping within redesignated special natural/interest areas	• Potential decreased management of former special management areas, particularly with regard to road management, use of dead and downed wood, vehicle-based camping; potential increased management from other resource elements (e.g., resource monitoring, waste disposal rules and regulations, erosion control, etc.)	• Key changes in existing management of special management areas and effects thereof include: ▪ allowing use of dead and downed wood in some portions redesignated ACECs and within 150 feet of the former Backcountry Byway where this activity is currently prohibited, which could affect wildlife and wildlife habitat in these areas ▪ 32 percent reduction of road networks within redesignated ACEC special natural/interest areas, which would reduce impacts from vehicles and vehicle-associated activities and over time would rehabilitate larger unroaded areas	• Potential for the same or increased management provisions for special natural/interest areas, including: ▪ prohibiting use of dead and downed wood and native campfires within and outside of special management areas ▪ 42 percent reduction of road networks within redesignated ACEC special natural/interest areas, which would reduce impacts from vehicles and vehicle-associated activities and over time would rehabilitate larger unroaded areas

Outdoor Recreation				
Proposed Action	**Strategy A**	**Strategy B**	**Strategy C**	**Strategy D**
• Affects BMGR recreational opportunities as follows: ▪ Recreational driving: includes continued prohibition of off-road driving, reduction of the road network available to the public by 36 percent (mostly redundant roads in localized areas), prohibition of driving in washes unless they are part of the designated road system open to the public and are dry, and a special use permit for single parties with more than 10 vehicles (20 within Management Unit 2) required ▪ Camping: vehicle-based camping would continue to be allowed within 50 feet of public use roads with a 14-day consecutive stay limit, but this would be further limited by the closure of roads and localized restrictions along road segments and within ¼-mile of sensitive resources in addition to wildlife waters ▪ Wood gathering and firewood use: use of dead and downed wood for campfires allowed except for within Unit 1, new prohibition of native wood fires within Unit 1 (Tinajas Altas area) ▪ Rockhounding: limited to Management Units 2 and 3 (which includes BMGR-West area open to public access outside of Tinajas Altas area) and 25 pounds per person and restricted from redesignated ACECs; prohibited in Units 1, 4, 5, 6, and 7 (which includes Tinajas Altas area of BMGR-West and all of BMGR-East) ▪ Metal detectors: prohibited range-wide because of buried unexploded ordnance hazards ▪ Mine exploration: prohibited range-wide because of extreme safety hazards and bat roosting habitat ▪ Recreation shooting: not restricted except that a special use permit is required for shooting automatic weapons and at night ▪ Potential for additional effects based on the findings of assessments including a nominal fee for hunting on the BMGR, restrictions or limitations on non-game species collection, and establishment of designated camping and/or recreational shooting areas	• Affects BMGR recreational opportunities as follows: ▪ Recreational driving: includes continued prohibition of off-road driving, no reduction of the road network available to the public (totaling 968 miles), potential driving in some washes subject to the finalization of the Barry M. Goldwater East HMP, special use permit for single parties with more than 50 vehicles required ▪ Camping: no change from current conditions (vehicle-based camping must be within 50 feet of existing public use roads with a 14-day consecutive stay limit, no camping within ¼-mile of a wildlife water) ▪ Wood gathering and firewood use: collection of dead and downed wood would continue to be prohibited within ACECs and within 150 feet of Backcountry Byway ▪ Rockhounding: approved in all BMGR areas open to public access but limited to 24 pounds plus one piece per person ▪ Metal detectors: not restricted ▪ Mine exploration: all mines are off-limits to public entry ▪ Recreational shooting: may occur if compatible with military activities and public safety	• Affects BMGR recreational opportunities as follows: ▪ Recreational driving: includes continued prohibition of off-road driving, consideration of future designated off-road vehicle use area, no reduction of the road network available to the public (totaling 968 miles) potential establishment or opening of new roads for public use, public driving in designated washes, and a special use permit for single parties with more than 30 vehicles required ▪ Camping: would allow vehicle based camping within 100 feet of existing public use roads with a 14-day consecutive stay limit, but not within ¼-mile of a wildlife water ▪ Wood cutting and gathering and firewood use: no restrictions on any of these activities unless a regulatory compliance issue arises (except for prohibiting removal of wood from the range) ▪ Rockhounding: approved in all BMGR areas open to public access but limited to 24 pounds plus one piece per person ▪ Metal detectors: not restricted ▪ Mine exploration: all mines are off-limits to public entry ▪ Recreational shooting: may occur if compatible with military activities and public safety ▪ Potential for additional effects based on the findings of assessments including a nominal fee for hunting on the BMGR, restrictions or limitations on-game species collection, and establishment of designated recreational shooting and camping areas	• Affects on BMGR recreational opportunities as follows: ▪ Recreational driving: includes continued prohibition of off-road driving, reduction of the road network available to the public by 36 percent (mostly redundant roads in localized areas), prohibition of driving in washes unless they are part of the designated road system open to the public and are dry, and a special use permit for single parties with more than 20 vehicles required ▪ Camping: vehicle-based camping would continue to be allowed within 50 feet of public use roads with a 14-day consecutive stay limit, but this would be further limited by the closure of roads and localized restrictions along road segments and within ¼-mile of sensitive resources in addition to wildlife waters ▪ Wood gathering and firewood use: use of dead and downed wood for campfires allowed, all other forms of wood cutting or wood collection prohibited ▪ Rockhounding: limited to Management Units 2 and 3 (which includes BMGR-West area open to public access outside of Tinajas Altas area) and 25 pounds per person and restricted from redesignated ACECs; prohibited in Units 1, 4, 5, 6, and 7 (which includes Tinajas Altas area of BMGR-West and all of BMGR-East) ▪ Metal detectors: prohibited range-wide because of buried unexploded ordnance hazards ▪ Mine exploration: prohibited range-wide because of extreme safety hazards and bat roosting habitat ▪ Recreational shooting: not restricted except that a special use permit is required for shooting automatic weapons and at night ▪ Potential for additional effects based on the findings of assessments including a nominal fee for hunting on the BMGR, restrictions on non-game species collection, and establishment of designated camping areas	• Affects on BMGR recreational opportunities as follows: ▪ Recreational driving: includes continued prohibition of off-road driving, the reduction of the road network available to the public by 43 percent (mostly redundant roads in localized areas but also includes some cross regional routes), prohibition of driving in washes unless they are part of the designated road system open to the public and are dry, and special use permit for single parties with more than 10 vehicles required ▪ Camping: vehicle-based camping would continue to be allowed within 50-feet of public use roads with a 7-day consecutive stay limit, but this would be further limited by the closure of roads and localized restrictions along road segments and within ¼-mile of sensitive resources in addition to wildlife waters ▪ Wood gathering and firewood use: wood cutting and gathering prohibited, use of native wood for campfires prohibited ▪ Rockhounding, recreational shooting, use of metal detectors, and entry to mines all prohibited ▪ Potential for additional effects based on the findings of assessments including a nominal fee for hunting on the BMGR and establishment of designated camping areas. A request would be submitted to Arizona Game and Fish Commission to close BMGR to non-game species collection.
• Effects on BMGR recreational setting (i.e., appearance and character) would be mixed. Over time, road closures and enforcement of prohibitions on off-road driving would lead to a generally more natural and less intensively used appearing environment, but there may be increased evidence of other recreational users in some areas (e.g., along popular remaining open road corridors and at possible designated camping and recreational shooting areas and from land management/recreation use supervision)	• Little change to existing BMGR recreational setting would be expected, but some further and more widely distributed low-level deterioration of this setting would be likely over the long term in the absence of road closures or other use limitations. Implementation of the transportation plan could eventually lead to changes similar to the proposed action relative to road closures and reduced area for vehicle-based camping.	• Little change to existing BMGR recreational setting, less evidence of other recreational users and land management/recreation use supervision, additional seclusion for vehicle-based campers; ORV use areas were established, recreational setting would be affected within localized area	• Effects on BMGR recreational setting (i.e., appearance and character) would be mixed. Over time, road closures and enforcement of prohibitions on off-road driving would lead to a generally more natural and less intensively used appearing environment, but where there may be increased evidence of other recreational users in some areas (e.g., along popular remaining open road corridors, at possible designated camping and recreational shooting areas, and from land management/recreation use supervision)	• Effects on BMGR recreational setting would be mixed with the most dominant natural environmental conditions of all alternatives, but evidence of other recreational users (from road closures and reduced area for vehicle-based camping and possible designated camping and recreational shooting areas) and land management/recreation use supervision would be slightly greater than with the proposed action

Outdoor Recreation (continued)				
Proposed Action	**Strategy A**	**Strategy B**	**Strategy C**	**Strategy D**
• Road closures and other use limitations may deter some members of the public from visiting the BMGR but the long-term trend in recreation use of the range is expected to show a steady increase in visitation	• Long-term trend of increased recreation use would be expected although some members of the public looking for a natural setting less effected by roads and vehicle-based activities may be deterred from visiting	• There would be potential for decreases in BMGR recreation use patterns based on proposed assessments (e.g. a potential fee for hunting); however, if an ORV use area were established, recreation use might increase; the long-term trend would likely be for the increased use but possibly at the expense of visitors desiring a natural setting less dominated by roads and vehicle-based activities	• Effects on BMGR recreation use would be mixed, with a greater potential for decreased use than increased use, but overall trend of increased visitation would be predominant	• Effects on BMGR recreation use would be mixed, with the greatest potential for decreased use of all the alternatives, but overall trend of increased visitation would be predominant
• Would result in a fundamental change to a limits of acceptable change approach to recreational management, which would directly link recreation management decision-making with resource conservation, rehabilitation, and protection of objectives. If the findings of the inventory and monitoring reveal that deleterious effects are occurring as a result of recreation use, adaptive management responses could modify, limit, or restrict recreational access or activities to address identified resource conservation and protection problem. Potential negative or limiting effects on public access/recreation may be offset by enhanced visitor education or law enforcement to reduce potential for exceeding limits of acceptable change thresholds	• No management tools providing effects-based linkages between decision-making for resource conservation, rehabilitation, or protection and regulation of public access and recreation activities would be established; rather, recreation management would remain on a reactionary, regulatory compliance-based footing • Some types of recreation management would continue to be somewhat defined by the redesignated ACECs, SRMAs, and Backcountry Byway rather than by the INRMP management units; there would be no additional or revised rules or prohibitions to implement nor a minimum required number of law enforcement officers	• For the most part, recreation management would occur based on current programs without a change to a limits of acceptable change and adaptive management approach; no special management provisions would be continued for the expired ACECs, SRMAs, and Backcountry Byway and no other special natural/interest areas would be established other than the flat-tailed horned lizard HMA, so nearly all recreation management would be based on either a range-wide or a unit-by-unit basis; a minimum of two law enforcement officers would be required	• Would result in a fundamental change to a limits of acceptable change approach to recreational management, which would directly link recreation management decision-making with resource conservation, rehabilitation, and protection of objectives. If the findings of the inventory and monitoring reveal that deleterious effects are occurring as a result of recreation use, adaptive management responses could modify, limit, or restrict recreational access or activities to address identified resource conservation and protection problem. Potential negative or limiting effects on public access/recreation may be offset by enhanced visitor education or law enforcement to reduce potential for exceeding limits of acceptable change thresholds	• Would result in a fundamental change to a limits of acceptable change approach to recreational management, which would directly link recreation management decision-making with resource conservation, rehabilitation, and protection of objectives. If the findings of the inventory and monitoring reveal that deleterious effects are occurring as a result of recreation use, adaptive management responses could modify, limit, or restrict recreational access or activities to address identified resource conservation and protection problem. Potential negative or limiting effects on public access/recreation may be offset by enhanced visitor education or law enforcement to reduce potential for exceeding limits of acceptable change thresholds
• Other minor proposed changes to recreation management would include use of INRMP management units and objectives related to record keeping system, minimum number of law enforcement officers, gates and fencing, and coordinating with adjacent land managers. Based on new or revised rules or prohibitions, there would be an increased recreation management workload			• Other minor proposed changes to recreation management would include use of INRMP management units and objectives related to record keeping system, minimum number of law enforcement officers, gates and fencing, and coordinating with adjacent land managers. Based on new or revised rules or prohibitions, there would be an increased recreation management workload	• Other minor proposed changes to recreation management would include use of INRMP management units and objectives related to record keeping system, minimum number of law enforcement officers, gates and fencing, and coordinating with adjacent land managers. Based on new or revised rules or prohibitions, there would be an increased recreation management workload
• Minor effects on recreation outside of the BMGR may occur if recreational users visit non-BMGR locations for outdoor recreation opportunities that would no longer be available or more strictly controlled on the BGMR, plus any impacts to recreationalists from agency use of roads within the northwest Cabeza Prieta NWR Wilderness would be eliminated (if refuge bypass roads were established)	• No change in recreation use in the vicinity of the BMGR as a result of management changes within the range would be expected, at least in the short term; future management planning including future transportation planning could divert recreational use from the BMGR to off-range locations	• No change in recreation use in the vicinity of the BMGR as a result of use limitations within the range would be expected, at least in the short term; however, minor decreased uses of off-range lands may occur if new on-range opportunities are established (an ORV use area, entry to mine[s]) and increases may occur if there are new restrictions (e.g., fee for hunting); would have the same effects as the proposed action with the refuge bypass roads	• Minor effects on recreation outside of the BMGR may occur if recreational users visit non-BMGR locations for outdoor recreation opportunities that would no longer be available or more strictly controlled on the BGMR, plus any impacts to recreationists from agency use of roads within the northwest Cabeza Prieta NWR Wilderness would be eliminated (if refuge bypass roads were established)	• More minor effects on recreation outside of the BMGR may occur as compared to the proposed action if recreational users visit non-BMGR locations for outdoor recreation opportunities that would no longer be available or more strictly controlled on the BGMR, plus any impacts to recreationists from agency use of roads within northwest Cabeza Prieta NWR Wilderness would continue (as no refuge bypass roads would be established)
Public Health and Safety				
Proposed Action	**Strategy A**	**Strategy B**	**Strategy C**	**Strategy D**
• New rules of conduct would slightly reduce the risks associated with visitor activities. These include implementing sewage and waste disposal rules, prohibiting wood cutting, prohibiting metal detectors; all safety requirements associated with military activities would continue to be implemented	• No additional public health and safety objectives would be implemented; all safety requirements associated with military activities would continue to be implemented	• New sewage and waste disposal rules would be implemented; all safety requirements associated with military activities would continue to be implemented. Potential for new risks if public entry to mines is allowed or designated ORV use areas are established.	• New rules of conduct would slightly reduce the risks associated with visitor activities. These include implementing sewage and waste disposal rules, prohibiting wood cutting, prohibiting metal detectors; all safety requirements associated with military activities would continue to be implemented	• New rules of conduct would reduce the risks associated with visitor activities. These include implementing sewage and waste disposal rules, prohibiting wood cutting, prohibiting metal detectors, and prohibiting recreational shooting; all safety requirements associated with military activities would continue to be implemented
Law Enforcement				
Proposed Action	**Strategy A**	**Strategy B**	**Strategy C**	**Strategy D**
• Closure of approximately 36 percent of public access road mileage would increase law enforcement workload in the short term (to keep visitors off of closed roads), but would decrease the miles of road to patrol	• Retention of existing road network would result in same number of miles of road to patrol, but would not increase workload associated with enforcing road closures	• Retention of existing road network and potential addition of new roads could increase the number of miles of road to patrol, but would not increase workload associated with enforcing road closures	• Closure of approximately 36 percent of public access road mileage would increase law enforcement work load in the short term (to keep visitors off of closed roads), but would decrease the miles of road to patrol	• Closure of approximately 43% of public access road mileage would increase law enforcement workload in the short term (to keep visitors off closed roads), but would decrease the miles of road to patrol in the long term after roads revegetate

Law Enforcement (continued)				
Proposed Action	**Strategy A**	**Strategy B**	**Strategy C**	**Strategy D**
• Management provisions for the following resource management elements could create additional law enforcement requirements on the range: ▪ motorized access and unroaded area management ▪ wood collection and firewood use restrictions (in Unit 1) ▪ recreational shooting limitations ▪ single-party vehicle limits	• Law enforcement requirements would not increase relative to existing conditions	• Management provisions for the following resource management elements could create additional law enforcement responsibilities on the range, although not to the degree of the proposed action: ▪ camping and visitor stay limits	• Management provisions for the following resource management elements could create additional law enforcement requirements on the range: ▪ motorized access and unroaded area management ▪ recreational shooting limitations ▪ single-party vehicle limits ▪ rockhounding limitations	• Management provisions for the following resource management elements could create the greatest amount of law enforcement requirements on the range: ▪ motorized access and unroaded area management ▪ 7-day camping and visitor stay limits ▪ rockhounding prohibition ▪ wood collection and native firewood use ▪ recreational shooting prohibition ▪ soil and water resources
• Increased responsibilities would be alleviated by the retention o f a minimum of six full-time law enforcement positions on the range	• No minimum number of law enforcement positions required	• Although additional burden would be placed on DoD law enforcement, there would be a minimum of two full-time law enforcement positions	• Increased responsibilities would be alleviated by the retention of a minimum of four full-time law enforcement positions on the range	• Increased responsibilities would be alleviated by the retention of a minimum of six full-time law enforcement positions on the range
Transboundary and Domestic Perimeter Land Use				
Proposed Action	**Strategy A**	**Strategy B**	**Strategy C**	**Strategy D**
• Changes in management could potentially result in a minor shift in recreation use away from the BMGR to adjacent lands because of new limitations on recreational opportunities	• No change in visitation patterns to the BMGR or other locations within the BMGR region are anticipated as a result of new creation use limitations within the BMGR	• Potential new recreation opportunities could potentially attract a minor amount of recreational use to the BMGR and away from adjacent lands (change would be expected to be small)	• Changes in management could potentially cause a minor shift in recreation use away from the BMGR to adjacent lands because of new limitations on recreational opportunities	• Changes in management could potentially cause a minor shift in recreation use away from the BMGR to adjacent lands because of new limitations on recreational opportunities
• Land management decisions based on shared data and increased coordination between BMGR land managers and adjacent land managers would occur under objectives for: ▪ resource inventory and monitoring ▪ wildlife water development research ▪ surveys for special status species ▪ soil surveys ▪ perimeter land management coordination and regional planning	• No increased emphasis in coordination or information sharing between the BMGR and adjacent land managers would be promoted	• Although it would occur to a lesser degree than the proposed action, land management decisions based on shared data between BMGR land managers and adjacent land managers would occur under management objectives for: ▪ surveys for special status species ▪ perimeter land manager coordination and regional planning	• Land management decisions based on shared data and increased coordination between BMGR land managers and adjacent land managers would occur under objectives for: ▪ resource inventory and monitoring ▪ wildlife water development research ▪ surveys for special status species ▪ perimeter land manager coordination and regional planning	• Land management decisions based on shared data and increased coordination between BMGR land managers and adjacent land managers would occur under objectives for: ▪ resource inventory and monitoring ▪ wildlife water development research ▪ surveys for special status species ▪ soil surveys ▪ perimeter land manager coordination and regional planning
Cultural Resources				
Proposed Action	**Strategy A**	**Strategy B**	**Strategy C**	**Strategy D**
• Resource survey and monitoring in support of ICRMP objectives would emphasize increased focus on identifying sources and extent of actual and potential impacts as a result of public access and government activities	• Resource surveys and compliance monitoring and survey, in accordance with the ICRMP, would identify some sources of impacts on cultural resources resulting from public access and government activities but less effectively than the proposed action	• Resource survey and compliance monitoring would function as for Strategy A but additional emphasis on compliance may improve cultural resources protection effects	• Resource survey and monitoring in support of ICRMP objectives would emphasize increased focus on identifying sources and extent of actual and potential impacts as a result of public access and government activities	• Resource survey and monitoring in support of ICRMP objectives would emphasize increased focus on identifying sources and extent of actual and potential impacts as a result of public access and government activities
• Redesignation of the expired Tinajas Altas Mountains ACEC as a special natural/interest area would promote continuing protection of sensitive cultural resources	• Redesignating ACECs, SRMA, HMA, and Backcountry Byway as special natural/interest areas and continuing the management provisions for these special management areas would continue to provide some protection of cultural resources within these locations	• Not redesignating special management areas as special natural/interest areas could potentially reduce protection of cultural resources	• Redesignation of the expired Tinajas Altas Mountains ACEC as a special natural/interest area would promote continuing protection of sensitive cultural resources	• Redesignation of the expired Tinaja Altas Mountains ACEC as a special natural/interest area would promote continuing protection of sensitive cultural resources
• Reducing the road network would likely reduce intentional and unintentional impacts on cultural resources in areas where roads are closed	• Retaining the current road network would likely result in more unintentional and intentional greater cultural resource impacts as compared to the reduced road network under the proposed action	• Potential increase in road network beyond current conditions could increase impacts to cultural resources in areas that were previously inaccessible by vehicles • Establishing public off-road driving areas would likely conflict with ICRMP goal to preserve cultural resources in place to the extent compatible with military missions	• Reducing the road network would likely reduce intentional and unintentional impacts on cultural resources in areas where roads are closed	• Reducing the road network would likely reduce intentional and unintentional impacts on cultural resources in areas where roads are closed

Cultural Resources (continued)				
Proposed Action	**Strategy A**	**Strategy B**	**Strategy C**	**Strategy D**
• Provisions to close selected road segments (if effective alternative protective measures are not available) to protect sensitive cultural resources, restrict camping within ¼ mile of designated sensitive cultural resources, conserve unroaded areas, reduce single-party vehicle limit to 19 (vs. the current limit of 49) without a special use permit, prohibit the use of metal detectors, prohibit recreational shooting with automatic weapons without a special use permit, restrict rockhounding in Units 2 and 3 from special natural/interest areas or other designated locations, and prohibit rockhounding in Units 1, 4, 5, 6, and 7, would reduce the potential for intentional and unintentional impacts on cultural resources • Increasing the emphasis on educating visitors about cultural resource values, sensitivities, and legal protections and increasing the law enforcement presence on the range would reduce the risks of both unintentional and intentional damage/theft of these resources	• Continuing the existing limits and restrictions on recreation activities would leave the potential unintentional and intentional impacts on cultural resources unchanged compared to existing conditions	• Impacts could increase by extending the allowance for vehicle-based camping along road margins to 100 feet	• Provision to restrict camping within ¼-mile of designated sensitive cultural resources could reduce potential for adverse impacts and intentional vandalism • Increasing the emphasis on educating visitors about cultural resource values, sensitivities, and legal protections and increasing the law enforcement presence on the range would reduce the risks of both unintentional and intentional damage/theft of these resources • Provisions to regulate or prohibit recreational activities would have the same potential to protect cultural resources as the proposed action except that rockhounding would be allowed range-wide and restricted only from special natural/interest areas or other specially designated locations which would slightly increase the potential for cultural resource damage from this activity compared to the proposed action	• Provision to restrict camping within ¼-mile of designated sensitive cultural resources could reduce potential for adverse impacts and intentional vandalism • Increasing the emphasis on educating visitors about cultural resource values, sensitivities, and legal protections and increasing the law enforcement presence on the range would reduce the risks of both unintentional and intentional damage/theft of these resources • Provisions to regulate or prohibit recreational activities would have the same potential to protect cultural resources as the proposed action except that rockhounding and recreational shooting would be prohibited everywhere on the range, which would eliminate potential cultural resource damage from these activities, and the single-party vehicle limit would be further reduced to 9 and the visitor stay limit per 28 day period would be reduced to 7 consecutive days, which would also slightly further reduce the potential of cultural resources damage from recreational activities
Visual Resources				
Proposed Action	**Strategy A**	**Strategy B**	**Strategy C**	**Strategy D**
• Road closures and recreation use management would result in a shift in the visual setting over time from a more semi-primitive setting towards a more primitive condition, where there are larger unmodified appearing areas; plus, active restoration in areas that have been damaged by a discontinued military, agency, or intensive public use could eliminate some visual scars	• Existing road network and semi-primitive setting would be retained, does not include objectives for restoration of closed roads or discontinued use areas	• Due to potential creation of new roads and increased public access and use opportunities, manmade modification would be more predominant than under the current conditions; although restoration in areas that have been damaged by a discontinued military, agency, or intensive public use could eliminate some visual scars	• Road closures and recreation use management would result in a shift in the visual setting over time from a more semi-primitive setting towards a more primitive condition, where there are larger areas that are unmodified appearing areas, plus, active restoration in areas that have been damaged by a discontinued military, agency, or intensive public use could eliminate some visual scars	• More road closures and resource protection than the proposed action, plus active restoration of closed roads (where feasible) and in areas that have been damaged by a discontinued military, agency, or intensive public use could eliminate some visual scars
• Developing up to six new wildlife waters during first five years of the INRMP (could be more depending on the results of studies) would create new minor manmade modifications to the near- to middle-ground landscape, however, waters can now be developed that are unobtrusive unless a new access road is required	• Developing up to 17 new wildlife waters would create new minor manmade modifications to the landscape (up to six would be implemented during the first five years of the INRMP); site-specific impacts would be dependent on the location and type of development	• Developing up to 17 or more new wildlife waters would create new minor manmade modifications to the landscape (up to six would be implemented during the first five years of the INRMP); site-specific impacts would be dependent on the location and type of development	• Developing up to six new wildlife waters in first five years of the INRMP (could be more depending on the results of studies) would create new minor manmade modifications to the near- to middle-ground landscape, however, waters can now be developed that are unobtrusive unless a new access road is required	• Suspending wildlife water developments during the first five years of the plan (and potentially longer) would eliminate this minor source of visual modification (at least in the first five years of the INRMP)
• Potential to concentrate recreation use areas (such as designated camping areas) could detract from the natural conditions in local areas, but would be offset by a change in viewer expectations	• Recreation use would remain dispersed and therefore there would be no change in the visual setting	• Recreation use would remain dispersed and therefore there would be no change in the visual setting	• Potential to concentrate recreation use areas (such as designated camping areas) could detract from the natural conditions in local areas, but could be offset somewhat by a change in viewer expectations	• Potential to concentrate recreation use areas (such as designated camping areas) could detract from the natural conditions in local areas to a slightly greater extent than the proposed action, but could be offset somewhat by a change in viewer expectations
• Potential development of Yuma Area Service Highway would be a new modification in the westernmost portion of the BMGR and create new viewpoints within the BMGR	• Any future utility/transportation corridors projects would create manmade modifications	• Potential development of Yuma Area Service Highway would be a new modification in the westernmost portion of the BMGR and create new viewpoints within the BMGR; additional corridor projects could have similar visual effects	• Potential development of Yuma Area Service Highway would be a new modification in the westernmost portion of the BMGR and create new viewpoints within the BMGR	• Yuma Area Service Highway and all other future corridor projects would be prohibited, which would preclude related impacts to visual resources
• Continues existing visual resource management objectives; site-specific projects would be assessed for visual resource impacts through regulatory compliance process and needed management or mitigation actions would be implemented	• Continued visual resource management policies would extend existing visual resource effects, does not include an objective to assess the visual effects of new actions	• Continues existing visual resource management objectives; site-specific projects would be assessed for visual resource impacts through regulatory compliance process, and needed management or mitigation actions would be implemented	• Visual resource management objectives include those of the proposed action, plus the visual effects of new actions would be assessed using BLM's visual resource management objectives	• Provide a greater extent of BMGR visual resources management objectives than the proposed action; effects of new actions would be assessed using BLM's visual resource management objectives and additional measures for visual resource management in unroaded areas are included

Hazardous Materials and Waste				
Proposed Action	**Strategy A**	**Strategy B**	**Strategy C**	**Strategy D**
• Decreases the potential area in which a release of hazardous materials or wastes transported by vehicles might occur by reducing the road network by about 30 percent; potential designated recreational shooting and camping areas, if established, would introduce areas of concentrated sources of human sewage, trash, vehicle fluids, and lead bullets	• No change in potential areas in which a release of hazardous materials or wastes release might occur,	• Increases the potential area in which a release of hazardous materials or wastes might occur by retaining the existing road network and providing opportunities to expand the road network	• Decreases the potential area in which a release of hazardous materials or wastes transported by vehicles might occur by reducing the road network by about 30 percent; potential designated recreational shooting and camping areas. if established, would introduce areas of concentrated sources of human sewage, trash, vehicle fluids, and lead bullets	• Decreases the potential area in wh ich a release of hazardous materials or wastes transported by vehicle might occur by reducing the road network by about 34 percent; potential designated camping areas, if established, would introduce areas of concentrated sources of human sewage, trash, and vehicle fluids, prohibiting recreational shooting would eliminate the need for designated shooting areas and associated hazardous materials and waste issues.
• Limiting visitor stays to 14 days and limiting party sizes to 9 (Units 1, 3, 6, 7) or 19 (Unit 2) vehicles (except by special use permit) for the majority of the range, could minimize the potential for hazardous materials or waste dumping on the BMGR • Increased emphasis on visitor education and law enforcement patrols would increase deterrence of unintentional and intentional disposal of hazardous materials or wastes	• Allowing large party sizes (up to 49 vehicles) without a special use permit and lack of a minimum number of law enforcement positions reduces potential to minimize illegal disposal compared to the proposed action	• Increasing recreational opportunities on the BMGR (which could attract larger numbers of visitors), allowing larger party sizes (up to 29 vehicles without a special use permit) than proposed action, and retaining a minimum to two law enforcement positions to patrol a large area reduces the potential to prevent hazardous material and waste disposal compared to the proposed action	• Limiting visitor stays to 14 days, limiting party sizes to 19 vehicles (except by special use permit) could minimize quantity of waste on BMGR, but not as effectively as proposed action • Increased emphasis on visitor education and law enforcement patrols would increase deterrence of unintentional and intentional disposal of hazardous materials or wastes	• Limiting visitor stays to 7 days, limiting party sizes to nine vehicles (except by special use permit) could minimize quantity of waste on BMGR; effect would be similar to, but slightly better than, the proposed action • Increased emphasis on visitor education and law enforcement patrols would increase deterrence of unintentional and intentional disposal of hazardous materials or wastes
Socioeconomic Resources				
Proposed Action	**Strategy A**	**Strategy B**	**Strategy C**	**Strategy D**
• Increases work and/or expenditures within the socioeconomic study area with implementation of additional inventory, monitoring, surveying, and studies; retaining at least six law enforcement officers; expanding public education programs; and implementing program objectives	• Does not introduce new activities that would generate additional work and/or result in expenditures	• Slightly increases work and/or expenditures, but fewer work opportunities than with proposed action	• Increases work and/or expenditures within the socioeconomic study area with implementation of additional inventory, monitoring, surveying, and studies; retaining at least four law enforcement officers; expanding public education programs; and implementing program objectives; somewhat less work generated than the proposed action	• Increases work and/or expenditures within the socioeconomic study area with implementation of additional inventory, monitoring, surveying, and studies; retaining at least six law enforcement officers; expanding public education programs; and implementing program objectives; somewhat more work generated than the proposed action
• Potentially decreases range visitation and recreation use by reducing the existing road network and recreational opportunities; could reduce visitor purchase of goods, services, and sundries from nearby communities (although amounts would likely be negligible and overall increase in visitation would be predominant in the long term)	• Would not promote change in existing visitation patterns so visitor purchases in nearby communities would remain unchanged by this alternative	• Potentially increases range visitation and recreation use because of increased recreational opportunities; could potentially increase visitor purchases in nearby communities (although amounts would likely be negligible and overall increase in visitation would be predominant in the long-term)	• Potentially decreases range visitation and recreation use by reducing the existing road network and recreational opportunities; could reduce visitor purchase of goods, services, and sundries from nearby communities (although amounts would likely be negligible and overall increase in visitation would be predominant in the long-term)	• Potentially decreases range visitation and recreation use by reducing the existing road network and recreational opportunities; could reduce visitor purchase of goods, services, and sundries from nearby communities (while amounts would likely be negligible, the decreases could be greater than with the proposed action, but an overall increase in visitation would be predominant in the long-term)
• Complements those public attitudes and values that favor a balance of public access and use opportunities and resource protection and conservation	• Public concerns about the shortcomings of management under the Goldwater Amendment would likely remain	• Supports the contingent whose attitudes and values favor public access and use opportunities	• Complements those public attitudes and values that favor a balance of public access and use opportunities and resource protection and conservation	• Supports the contingent whose attitudes and values favor resource protection and conservation
• Allows for Yuma Area Service Highway, which would support the local economy; prohibits any other future utility/transportation corridors, which could hinder utility company developments	• Would likely allow for Yuma Area Service Highway, which would support the local economy; restricts utilities to existing corridors, which could negatively hinder other potential utility developments in the region	• Allows for Yuma Area Service Highway and allows for consideration of additional utility/transportation corridors if compatible with the military mission, which would support the local economy and potentially other public utility/highway developments in the region	• Allows for Yuma Area Service Highway, which would be positive for the local economy; prohibits any other future utility/transportation corridors, which could negatively hinder other potential utility developments in the region	• Prohibits Yuma Area Service Highway, delaying project schedule and impacting the local economy; prohibits any other future in the utility/transportation corridors, which could hinder potential utility/transportation developments in the region

Noise				
Proposed Action	**Strategy A**	**Strategy B**	**Strategy C**	**Strategy D**
• Potentially decreases average environmental noise in localized settings by minor amounts, compared to existing conditions, as a result of reducing size of road network, limiting single parties to 9 (in Units 1, 3, 6, 7) or 19 (Unit 2) vehicles, without a special use permit, and restricting recreational shooting to daylight hours and prohibiting any use of automatic weapons without a special use permit	• No reduction in road network, single-party sizes of up to 49 vehicles without a special use permit, and no restrictions on recreational shooting at night or with automatic weapons would leave existing environmental noise conditions unchanged	• Potential expansion of road network and designation of public off-road vehicle areas could result in local increases in environmental noise conditions compared to the existing conditions	• Same environmental noise effects as proposed action except the single-party limit on vehicles, without a special use permit, would be 19 in all units which would have only a slight potential to increase noise above the proposed action level	• Includes about the same localized reduction in noise impacts range-wide as the proposed action; however, compared to the proposed action, decreases noise by also foreclosing the possibilities for Yuma Area Service Highway and all recreational shooting
Environmental Justice				
Proposed Action	**Strategy A**	**Strategy B**	**Strategy C**	**Strategy D**
• No environmental justice effect	• No environmental justice effect	• No environmental justice effect	• No environmental justice effect	• No environmental justice effect

TABLE S-7
SUMMARY OF MEANINGFUL AGGREGATE EFFECTS OF THE PROPOSED ACTION AND ALTERNATIVES ON INDIVIDUAL RESOURCES

Resource Impact Assessment Category	Area of Effect	Type of Effect				
		Proposed Action	Alternative Management Strategy A (No-Action)	Alternative Management Strategy B	Alternative Management Strategy C	Alternative Management Strategy D
Earth Resources	RW	⊙$_B$	○$_B$	○$_B$	⊙$_B$	●$_B$
Water Resources	RW	⊙$_B$	○$_B$	○$_B$	⊙$_B$	●$_B$
Climate and Air Resources	RW	ME	ME	□$_A$	ME	ME
General Vegetation	>RW	⊙$_B$	ME	ME	⊙$_B$	⊙$_B$
General Wildlife and Wildlife Habitat	>RW	⊙$_B$	ME	ME	⊙$_B$	⊙$_B$
Protected Species	>RW	⊙$_B$	ME	ME	⊙$_B$	⊙$_B$
Wildfire Management	>RW	⊙$_B$	NE	○$_B$	⊙$_B$	●$_B$
Grounds Maintenance	<MU	ME	ME	ME	ME	ME
Public Utilities and Transportation Corridors	>RW	□$_A$	□$_A$	□$_A$	□$_A$	□$_A$
Special Management Areas	RW	ME	ME	□$_A$	ME	⊙$_B$
Outdoor Recreation	MU	ME	ME	ME	ME	ME
Public Health and Safety	RW	⊙$_B$	NE	□$_A$	⊙$_B$	●$_B$
Law Enforcement	RW	ME	ME	○$_B$	ME	ME
Transboundary and Domestic Perimeter Land Use	>RW	ME	NE	ME	ME	ME
Cultural Resources	RW	⊙$_B$	□$_A$	□$_A$	⊙$_B$	●$_B$
Visual Resources	RW	○$_B$	○$_B$	○$_B$	⊙$_B$	●$_B$
Hazardous Materials and Waste	RW	ME	NE	□$_A$	ME	○$_B$
Socioeconomics	>RW	○$_B$	○$_B$	○$_B$	○$_B$	○$_B$
Noise	MU	ME	□$_A$	□$_A$	ME	⊙$_B$
Environmental Justice	>RW	NE	NE	NE	NE	NE

Type of Effect: Slightly Beneficial = ○$_B$ Beneficial = ⊙$_B$ More Beneficial = ●$_B$
Slightly Adverse = □$_A$ Adverse = □$_A$ More Adverse = ■$_A$
Mixed Effect (Includes mixed beneficial and adverse effects with no clear beneficial or adverse aggregate effect) = ME
No Effect = NE

Area of Effect: Smaller Than Management Unit = <MU Management Unit = MU Range Wide = RW Larger than Range Wide = >RW

of socioeconomics and public health and safety. One notable individual adverse effect on the human community, however, would result from the public utilities and transportation corridors management objectives in this strategy, which would preclude the development of new corridors, including the proposed Yuma ASH for which advanced planning and design efforts are currently underway. Also, regardless of management strategy, there is a potential for adverse effects on cultural resources within the BMGR as a result of recreation activities. The extent to which recreation use could be causing damage to cultural resources cannot be directly assessed until specific studies to address this issue are undertaken. However, Alternative Management Strategy D would establish parameters to control damage that vehicle use and other recreational activities may cause to off-road ground surfaces and vegetation communities, protect specific sensitive cultural resource sites, and minimize potential harm to cultural resources. Strategy D is the most restrictive of the alternatives in terms of limiting the extent and types of recreation use; consequently, this strategy would potentially be the most advantageous in terms of minimizing effects on cultural resources.

The proposed action would offer ecosystem management benefits of a similar but slightly less extensive nature. The proposed action includes some trade-offs that may be less beneficial to cultural resources as compared to Strategy D, but are less adverse in terms of some benefits for the human community. A key example is that the proposed action would support the development of the proposed Yuma ASH. Another tradeoff that may be regarded as a human community benefit is that the less extensive road closures of the proposed action would provide some additional motorized public access, particularly within Management Unit 2, for recreation. The proposed action would also maintain a limited program for developing up to six high-priority water developments as wildlife management tools during the first five-year period of the proposed INRMP, an outcome that may be favorable for the wildlife for which the waters are developed as well as other species. There is little distinction in aggregate impacts between Alternative Management Strategy C and the proposed action, but as Strategy C is less limiting in terms of restricting public access, this strategy could have slightly greater impacts on some resources and slightly less impact on recreation opportunity and use.

In contrast to the proposed action or Alternative Management Strategies C or D, the overall focuses of Alternative Management Strategies A and B are shifted in the direction of maintaining existing motorized public access and, under Strategy B, possibly expanding these opportunities. Strategies A and B also lack the emphasis on ecosystem and public use monitoring and adaptive management that the other alternatives provide. As a result, Strategies A and B would not offer as great a potential for long-term conservation and rehabilitation of natural communities and ecosystem functions and cultural resources protection as the proposed action or Alternative Strategies C or D. The potential aggregate effects of the no-action alternative (Strategy A) and Strategy B were found to be of mixed value for vegetation, wildlife, wildlife habitat, and protected species. This conclusion was reached not because the provisions of this strategy would cause direct

harm to these resources, but because these strategies would likely fall somewhat short of the long-term goal of facilitating restoration and improvements in the range ecosystem and biodiversity. Alternative Management Strategy B may be less beneficial as compared to the other actions as it allows for the careful consideration of some consumptive uses (e.g., off-road vehicle use areas, wood cutting, and public entry to mines) that previously have not been sanctioned on the range. Although Strategies A and B provide for more public access than the proposed action or Strategies C or D, the aggregate effect of Strategies A and B on outdoor recreation were also found to be mixed because of the continuing variances in the perspectives of different segments of the population regarding the appropriateness of various recreation activities and the desirable characteristics of environments in which to pursue activities of their choice.

Cumulative Effects

Cumulative effects are those additive or interactive effects that would result from the incremental impact of the proposed actions when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. The cumulative effects analysis provided in this EIS (Chapter 6) considers impacts that may occur at the individual resource, ecosystem, and human community scales. The discussion of cumulative effects in Chapter 6 as well as in this Executive Summary is limited to the ecosystem and human community scales, which is commensurate with the programmatic nature of the proposed INRMP.

The fact that the fundamental purposes of the proposed INRMP are to provide for the protection and conservation of natural and cultural resources of the BMGR and sustainable multipurpose public use, to the extent these objectives are consistent with the military purposes of the range, is directly relevant to the overall determination of the cumulative effects of the alternatives of this EIS when considered together with other past, present, and reasonably foreseeable future actions. As demonstrated by the analysis presented in this EIS, the BMGR represents a fairly well-protected and expansive environment that harbors some of the largest and least disturbed remaining tracts of indigenous Sonoran Desert. Some of the natural communities present on the range are the best surviving representatives of these community types in the entire Sonoran Desert ecoregion. This is not to say that the cumulative effects of past and present actions, including military and non-military activities, have not adversely affected the range environment. For most resource categories, including those for vegetation, wildlife, wildlife habitat, and protected species, the additive or interactive effects of past, present, and reasonably foreseeable future actions have been adverse and in some cases, such as protected species, and these effects have also been significant. The additive or interactive impact of past and present actions has been limited, however, and the overall BMGR ecosystem remains relatively healthy and intact.

The aggregate effects of the proposed action or Alternative Management Strategies C or D, when considered together with other past, present, and reasonably foreseeable future actions, would be beneficial for the greater BMGR ecosystem. Each of these alternatives emphasize ecosystem system management principals and would exert countervailing influences on the range ecosystem that would further the long-term restoration of the effects of past damage. Each of these alternatives would also enhance the management and regulation of ongoing use, and provide for management adaptation to respond to emerging threats to natural communities and the broader ecosystem.

The cumulative effects of the proposed action or Alternative Management Strategies C or D, when considered together with other past, present, and reasonably foreseeable future actions, on the human community would be mixed. None of these alternatives would be likely to have a cumulative economic effect of a measurable magnitude, but each would impact public use of the BMGR. The provisions of the proposed action or Alternative Management Strategies C or D would continue to provide public access to the range but would reduce some opportunities for recreational driving activities and impose some new limitations on recreational activities in favor of enhanced natural and cultural resources protection and conservation. Although these changes would not be individually significant within the BMGR, these new restrictions, when added to constraints on some types of vehicle-based use in other public lands locations outside of the range, would further diminish these types of recreational opportunities available in the BMGR region. In contrast, these restrictions would favor the cumulative regional availability of non-vehicle-based recreation.

On overall balance, the aggregate effects of Alternative Management Strategies A or B, when considered together with other past, present, and reasonably foreseeable future actions, would generally be protective of most range resources but would likely fall short of providing the long-term benefits for the greater BMGR ecosystem that are a goal of the proposed INRMP. In some respects, the fact that these alternatives would not reduce the current extent of vehicle travel within the BMGR or implement positive controls on the proliferation of additional wildcat roads could result in potentially negative long-term ecosystem effects.

The cumulative effects of Alternative Management Strategies A or B on the human community would also be mixed when considered together with other past, present, and reasonably foreseeable future actions. These alternatives would be favored by those who prefer vehicle-based recreational activities both within the BMGR and the region. Those members of the community who prefer recreational activities with less emphasis on recreational vehicle driving, however, would regard this effect as adverse.

CHAPTER 1
INTRODUCTION AND PURPOSE OF AND NEED FOR THE PROPOSED INRMP

1.1 INTRODUCTION

The Barry M. Goldwater Range (BMGR) in southwestern Arizona is a major U.S. military installation encompassing 1,733,921 acres (2,709 square miles) that is used by the U.S. Air Force and U.S. Marine Corps (hereafter Air Force and Marine Corps) primarily to train military aircrews to fly air combat missions. To a lesser extent, the range is also used to support some other types of national defense purposes, most of which support or are associated with air combat training.

This Environmental Impact Statement (EIS) was prepared to support development of a proposed Integrated Natural Resources Management Plan (INRMP) for the BMGR. Development of the INRMP is a statutory requirement of both the Military Lands Withdrawal Act (MLWA) of 1999 (Public Law [P.L.] 106-65) and the Sikes Act, as amended (most recently amended by the Sikes Act Improvement Amendments, hereafter "Sikes Act" [16 U.S. Code (U.S.C.) 670a et seq.]). The MLWA, which is the current federal statutory authorization for the BMGR, requires that the INRMP must provide for the:

> … proper management and protection of the natural and cultural resources of [the range], and for sustainable use by the public of such resources to the extent consistent with the military purposes [of the range]… [P.L. 106-65 §3031(b)(3)(E)(i)].

The MLWA also specifies that the INRMP must be prepared and implemented in accordance with the Sikes Act [P.L. 106-65 §3031(b)(3)(D)]. The Sikes Act sets forth resource management policies and guidance for U.S. military installations and requires the preparation of INRMPs for installations—including those, such as the BMGR, composed of withdrawn lands—with significant natural resources. The Sikes Act provides that the "… Secretary of Defense shall carry out a program to provide for the conservation and rehabilitation of natural resources on military installations…" and that an INRMP is to be prepared to facilitate implementation of that program [16 U.S.C. 670a (a)(1)(A) and (B)]. The Act also specifies that:

> Consistent with the use of military installations to ensure the preparedness of the Armed Forces, the Secretaries of the military departments shall carry out [the aforementioned program] to provide for—
>
> (A) the conservation and rehabilitation of natural resources on military installations;

(B) the sustainable multipurpose use of the resources, which shall include hunting, fishing, trapping and non-consumptive uses; and

(C) subject to safety requirements and military security, public access to [the BMGR] to facilitate the use [16 U.S.C. 670a (a)(3)].

As indicated by the preceding provisions of the MLWA of 1999 and Sikes Act, the resource conservation components of the pending INRMP for the BMGR will in many ways be comparable to those developed for many other federal land management plans including existing or pending plans for the nearby Organ Pipe Cactus National Monument (NM) and the adjacent Cabeza Prieta National Wildlife Refuge (NWR) and Bureau of Land Management (BLM) lands. The feature of the pending INRMP that will distinguish it most sharply from most other federal land management plans, however, is that implementation and control of the primary land use of the BMGR—which is the support of designated military purposes—is not subject to review or modification through the development of the INRMP. Decisions regarding current and future military land use at installations subject to Sikes Act planning are assessed through other processes, which may include planning under the auspices of the National Environmental Policy Act (NEPA) of 1969 [42 U.S.C. 4332] or other applicable environmental laws, but are not reviewed through the preparation of an INRMP. Rather, land management on a military installation must be consistent with the military purposes of the installation. In the case of the BMGR, Congress previously determined through the MLWA of 1999 that this range would be used first and foremost for specific national defense purposes [P.L. 106-65 §3031(a)(2)]. Management of natural resources and public access within the BMGR must be consistent with these specified national defense purposes. However, this national defense mandate for the BMGR does not preclude implementing a management plan that provides for effective conservation, protection, and rehabilitation of natural resources; protection of cultural resources; and opportunities for sustainable public use. Given the character of the military mission at the BMGR, there are opportunities to use, protect, and conserve resources within the range and latitude available to incorporate effective management methods.

1.1.1. EIS and INRMP Relationship

This Environmental Impact Statement (EIS) addresses five alternative strategies for managing natural and cultural resources and public access within the BMGR. Each of these alternative management strategies represents a potential resource management program, or an INRMP, for the BMGR. The alternative selected in the Record of Decision (ROD) for this EIS will constitute the management strategy that will be implemented for the BMGR.

An INRMP document will be extracted from the final EIS following the signing of the ROD. This document will be based on the alternative management strategy selected in the ROD and will be used to implement that alternative. Consistent with the MLWA of 1999; the Sikes Act;

and Department of Defense (DoD), Air Force, and Marine Corps guidance for preparing INRMPs, the major features of the final INRMP will include:

- purpose, authority, and development history of the INRMP
- future review and amendment procedures for the INRMP
- location and mission of the BMGR
- a brief land use and management history of the BMGR
- current and foreseeable future military missions and land-use
- non-military agency missions and land use
- incorporation of the Integrated Cultural Resources Management Plan (ICRMP) for the BMGR by reference
- provisions for meeting trust responsibilities and access and consultation requirements relative to affected Indian tribes
- public access opportunities and conditions
- overview of the BMGR environment
- resource management goals
- selected resource management alternative
- projects and schedule planned to implement the selected management alternative
- follow-on requirements under the NEPA, or other regulatory laws, to implement specific planned management projects

As already indicated, the statutory authority and guidance for developing the INRMP for the BMGR is provided by the MLWA of 1999 and Sikes Act. The statutory authority and guidance for preparing this EIS is provided by Section 102(2)(c) of the NEPA of 1969 [42 U.S.C. 4332], as implemented by the Council on Environmental Quality (CEQ) regulations (40 Code of Federal Regulations [CFR] 1500 to 1508), which requires federal agencies to consider potential environmental concerns as early as possible in the development of proposed programs, projects, and activities. The use of an EIS to support and guide the planning process for developing the

INRMP is consistent with 40 CFR §1502.4, §1502.25, and §1508.18; Air Force Instruction (AFI) 32-7061, as promulgated at 32 CFR §989, and Marine Corps Order (MCO) 5090.2A for implementing the NEPA; and AFI 32-7064 for integrated natural resources management and the Handbook for Preparing Integrated Natural Resources Management Plans on Marine Corps Installations.

The decision to prepare an EIS for the development of an INRMP for the BMGR was in response to a number of issues. The BMGR is a major federal land holding important for its diverse natural and cultural resources and public outdoor recreation use opportunities as well as its national defense values. When viewed from a regional perspective encompassing the BMGR, Cabeza Prieta NWR, Organ Pipe Cactus NM, and Sonoran Desert NM, the range is a principal component in the largest relatively unfragmented remaining tract of Sonoran Desert. The general public; Native Americans; and multiple federal, state, and local agencies have had a long-standing active interest in management of natural and cultural resources and public access within both the BMGR and the contiguous national monument and national wildlife refuge areas. The various members of these groups have voiced many divergent viewpoints on what would constitute appropriate long-term management of the BMGR.

The CEQ regulations that govern preparation of an EIS provide a readily adaptable planning process for developing the proposed INRMP for the BMGR. Among other advantages, the EIS planning process has well-established requirements and procedures for incorporating public, Native American, and government input, review, and comments in the decision-making process. These procedures directly support the MLWA of 1999 requirement that meaningful opportunities to comment on the proposed INRMP are provided to the state of Arizona, Indian tribes, and the public [P.L. 106-65 §3031(b)(3)(E)(ix)].

The public, Native American, and government involvement process in the development of the INRMP began with scoping for this EIS and has also included public workshops and other means of contact with Native Americans and various government agencies (see Section 1.8). Public scoping, the workshops, and other means of contact provided opportunities for input, review, and comment before the resource management goals and alternatives presented in this EIS for the INRMP were finalized. Consideration of the environmental consequences of alternative courses of action is at the heart of an EIS process [40 CFR §1502.14], which is the other primary advantage that the EIS process lent to the development of the proposed INRMP. This EIS addresses a wide range of reasonable alternatives for the management of natural resources and public access within the BMGR (see Chapter 3) and identifies the potential environmental consequences of implementing each alternative (see Chapter 5). The alternatives assessed were based on resource management goals that were developed in consideration of the input received during the scoping process and applicable statutory and regulatory requirements. Public, tribal, and agency input during scoping also confirmed that assessing a balanced range of

alternatives would be critical to the development of the INRMP and that any such alternatives must be based on clearly defined management purposes, needs, and goals.

The established approach for preparing an EIS provides several other advantages for developing an INRMP. An INRMP must be developed in consideration of both the existing environmental conditions of the installation, as well as the historical conditions and actions that have shaped its current environmental status, so that the potential outcomes of management alternatives may be analyzed and measured relative to the existing norm. The existing environment that would be affected by the INRMP management alternatives assessed in this EIS is described in Chapter 4. The content of Chapter 4 is typical for an affected environment section in an EIS, but this chapter does not include some of the foundation material supporting the development of the INRMP. Chapter 2, as presented in this EIS, is an exception to a standard EIS format and provides this foundation material as well as historical, legal, military mission, agency mission, military land use, military safety and security, and natural and cultural resource factors that will shape and/or control the content and direction of the INRMP.

As required of an EIS, Chapter 5 reports the projected environmental consequences of implementing each management alternative and the potential aggregate effects that could result from the implementation of a mix of management alternatives throughout the BMGR. Chapter 5 also addresses unavoidable adverse impacts and irreversible and irretrievable commitment of resources that would result from the implementation of the various alternatives. Chapter 6 describes the potential cumulative effects of each alternative when added to other past, present, or reasonably foreseeable future actions within the BMGR region of influence. The EIS concludes with a list of preparers; agencies, and organizations consulted in preparing this document; agencies, organizations, and persons receiving the draft EIS; and applicable appendices.

Opportunities for public, tribal, and government agency review and comment on the proposed INRMP continued throughout the EIS development process. Following the completion of public scoping and the workshops, the next opportunity for review and comment comes with the publication of the draft EIS. Comments received on the draft EIS will be considered and incorporated in the preparation of a final EIS for the INRMP. The final EIS will include the comments submitted during the review period and written responses to those comments. Any changes in the analysis of the alternatives prompted by comments on the draft EIS will be incorporated in the final EIS. The final EIS will also be publicly circulated.

The management alternative selected for implementation from among the range of reasonable alternatives considered in the draft EIS will constitute the basis for the INRMP for the BMGR. This selected alternative will be reported in the ROD for the EIS following the closure of the review period for the final EIS because each of the alternatives identified meet the underlying purpose and need. The alternative ultimately selected in the ROD may differ from the preferred

alternative identified in the final EIS, but will be selected from among the range of alternatives reviewed in the draft EIS. The selected INRMP alternative will be the alternative that the decision-making agencies believe will best fulfill their statutory missions and responsibilities, giving consideration to economic, environmental, technical and other factors. The ROD will also identify the environmentally preferred alternative or alternatives. The selected and environmentally preferred alternatives may be the same or may differ [40 CFR §1505.2(b)]. Comments on the final EIS will be considered in the selection of the alternative identified for implementation. A Notice of Availability (NOA) for the final EIS will be published in the Federal Register, with the ROD to be signed no sooner than 30 days after the NOA. After the decision is made in the ROD, the INRMP will be extracted from the EIS and be prepared as a management implementation document with the aforementioned major features. The Sikes Act and MLWA of 1999 require that a number of specific components be incorporated in the INRMP for the BMGR. The locations at which these components are addressed in this EIS are identified in Table 1-1.

Consistent with the Sikes Act, which does not address cultural resources management, the focus of the alternative management strategies examined in this EIS is on natural resources. As required by the MLWA of 1999 [P.L. 106-65 §3031(b)(3)(E)(i)], the final INRMP will also address cultural resources management by incorporating and supporting the goals of the ICRMP for the BMGR that were prepared and reviewed separately (see Section 1.6). Each of the alternative strategies for natural resources management examined in this EIS is consistent with these cultural resource goals.

The MLWA of 1999 also requires that the Secretaries of the Navy and Air Force develop the proposed INRMP in consultation with affected Indian tribes and include provisions in the plan that address how the Secretaries intend to meet the trust responsibilities of the United States relative to Indian tribes, lands, and treaty rights; allow tribal access to the BMGR; and provide for timely consultations with affected tribes [P.L. 106-65 §3031(b)(3)(E)(ii)]. The processes that are being employed for consulting with Indian tribes on the development of the proposed INRMP are described in Section 1.8 of this EIS. Section 1.7 provides an overview of how the Secretaries of the Navy and Air Force propose to meet the aforementioned trust responsibilities and access and other consultation requirements. These issues are addressed in detail in the separate ICRMP.

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TABLE 1-1
COMPONENTS OF THE INRMP FOR THE BMGR REQUIRED BY THE MLWA OF 1999 AND SIKES ACT

Component/Statutory Reference	Location(s) Where Component is Addressed in this EIS
MLWA of 1999	
1. "[Provide] for proper management and protection of the natural and cultural resources" [P.L. 106-65 §3031(b)(3)(E)(i)]	Sections: 1.1, 1.1.1, 1.2.5, 1.3, 1.4.1, 1.4.2, 1.4.3, 1.5, 1.5.1 through 1.5.5, 1.6, 1.7, 1.8, 2.1, 2.3.3, 2.4.1, 2.4.2, 2.5, 2.6, 2.7, 2.8, 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 4.2 to 4.11, 4.14 to 4.18, 4.20, 5.2 through 5.21, and 6.1 through 6.4
2. Provide for "sustainable use by the public of such resources to the extent consistent with the military purposes for which [the BMGR] lands are withdrawn and reserved" [P.L. 106-65 §3031(b)(3)(E)(i)]	Sections: 1.1, 1.1.1, 1.3, 1.4.1, 1.4.3, 1.5.2 through 1.5.5, 1.8, 2.1, 2.2, 2.2.1 through 2.2.9, 2.3.1, 2.3.2, 2.3.3, 2.4.2, 2.6, 2.7, 2.8, 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 4.12, 4.13, 4.20.2, 5.2.1, 5.2.3 through 5.2.8, 5.2.18, 5.3.1, 5.3.3 through 5.3.8, 5.3.18, 5.4.1, 5.4.3 through 5.4.8, 5.4.18, 5.5.1, 5.5.3 through 5.5.8, 5.5.18, 5.6.1, 5.6.3 through 5.6.8, 5.6.18, 5.7.1, 5.7.3 through 5.7.8, 5.7.18, 5.8.1, 5.8.3 through 5.8.8, 5.8.18, 5.11.1, 5.11.3 through 5.11.8, 5.11.18, 5.12, 5.13, 5.16.1, 5.16.3 through 5.16.8, 5.16.18, 5.17.1, 5.17.3 through 5. 17.8, 5.17.18, 5.20.1, 5.20.3 through 5.20.8, 5.20.18, and 6.1 through 6.4
3. Provide that the INRMP "be developed in consultation with affected Indian tribes" [P.L. 106-65 §3031(b)(3)(E)(ii)]	Sections: 1.6, 1.7, and 1.8.4
4. Provide how the Secretaries of the Navy and Air Force "intend to meet the trust responsibilities of the United States with respect to Indian tribes, lands, and rights reserved by treaty or Federal law affected by the withdrawal and reservation" [P.L. 106-65 §3031(b)(3)(E)(ii)(I)]	Section: 1.7
5. Provide how the Secretaries of the Navy and Air Force "intend to allow access to and ceremonial use of sacred sites to the extent consistent with the military purposes for which [the BMGR] lands are withdrawn and reserved" [P.L. 106-65 §3031(b)(3)(E)(ii)(II)]	Sections: 1.7, 1.8.4, 2.2.1 through 2.2.9, 2.7.3, 3.2, and 3.3
6. Provide how the Secretaries of the Navy and Air Force "intend to provide for timely consultation with affected Indian tribes" [P.L. 106-65 §3031(b)(3)(E)(ii)(III)]	Sections: 1.5.4, 1.7, and 1.8.4
7. "[P]rovide that any hunting, fishing, trapping on [the BMGR] be conducted in accordance with the provisions of section 2671 of title 10, United States Code" [P.L. 106-65 §3031(b)(3)(E)(iii)]	Sections: 2.4.2, 3.4, and 4.12.3.1
8. "[P]rovide for continued livestock grazing and agricultural out-leasing where it currently exists in accordance with the provisions of section 2667 of title 10, United States Code, and at the discretion of the Secretary of the Navy or the Secretary of the Air Force, as the case may be" [P.L. 106-65 §3031(b)(3)(E)(iv)]	Sections: 1.2.1, 2.3.1, 3.3, 3.4, and 4.6.1.8
9. "Identify current test and target impact areas and related buffer or safety zones" [P.L. 106-65 §3031(b)(3)(E)(v)]	Sections: 1.2.3, 1.4.3, 2.2, 2.2.1 through 2.2.9, 2.3.2, 2.6, 2.6.1, and 2.7

TABLE 1-1
COMPONENTS OF THE INRMP FOR THE BMGR REQUIRED BY THE MLWA OF 1999 AND SIKES ACT

Component/Statutory Reference	Location(s) Where Component is Addressed in this EIS
10. Provide that the Secretaries of the Navy and Air Force "take necessary actions to prevent, suppress, and manage brush and range fires occurring within the boundaries of the [BMGR], as well as brush and range fires occurring outside the boundaries of the [BMGR] resulting from military activities" [P.L. 106-65 §3031(b)(3)(E)(vi)(I)]	Sections: 1.9, 3.3, 3.4, 4.18, and 5.18
11. Provide that the Secretaries of the Navy and Air Force "may obligate funds appropriated or otherwise available to the Secretaries to enter into memoranda of understanding, and cooperative agreements that shall reimburse the Secretary of the Interior for costs incurred" assisting in fire prevention, suppression, and management [P.L. 106-65 §3031(b)(3)(E)(vi)(II)]	Section: 4.8.3
12. "[P]rovide that all gates, fences, and barriers constructed on [the BMGR] after the date of enactment of [the MLWA of 1999] be designed and erected to allow wildlife access, to the extent practicable and consistent with military security, safety, and sound wildlife management use" [P.L. 106-65 §3031(b)(3)(E)(vii)]	Sections: 3.2, 3.3, and 3.4
13. "[I]ncorporate any existing management plans pertaining to [the BMGR], to the extent that the [Secretaries of the Navy, Air Force, and Interior], upon reviewing such plans, mutually determined that incorporation of such plans into [the INRMP] is appropriate" [P.L. 106-65 §3031(b)(3)(E)(viii)]	Sections: 2.1, 3.2, 3.4.1, 4.2.3, 4.3.3, 4.4.3, 4.5.3, 4.6.3, 4.7.3, 4.8.3, 4.9.3, 4.10.3, 4.11.3, 4.12.3, 4.13.3, 4.14.3, 4.15.3, 4.16.3, 4.17.3, 4.18.3, 5.2 through 5.21, and 6.1 through 6.4
14. "[I]nclude procedures to ensure that the periodic reviews of the [INRMP] under the Sikes Act are conducted jointly by the [Secretaries of the Navy, Air Force, and Interior], and that affected States and Indian tribes, and the public, are provided a meaningful opportunity to comment upon any substantial revisions to the plan that may be proposed" [P.L. 106-65 §3031(b)(3)(E)(ix)]	Section: 1.5.4
15. "[P]rovide procedures to amend the [INRMP] as necessary" [P.L. 106-65 §3031(b)(3)(E)(x)]	Sections: 1.5.4
Sikes Act	
16. Provide for "fish and wildlife management, land management, forest management, and fish- and wildlife-oriented recreation" [16 U.S.C. 670a(b)(1)(A)]	Wildlife Management—Sections: 1.1, 1.1.1, 1.2.4, 1.3, 1.4.1, 1.4.2, 1.4.3, 1.5.2 through 1.5.5, 1.7, 1.8.1, 1.8.2, 1.8.3, 1.9, 1.10, 2.1, 2.3.3, 2.4.2, 2.5.1, 2.7, 2.8, 3.1 through 3.4, 3.6, 4.5 through 4.8, 4.11, 4.12.1.3, 4.12.1.4, 5.2.11, 5.2.12, 5.3.11, 5.3.12, 54.11, 5.4.12, 5.5, 5.6, 5.7, 5.8.11, 5.8.12, 5.9.11, 5.9.12, 5.10.11, 5.10.12, 5.11.11, 5.11.12, 5.12.11, 5.12.12, 5.13.11, 5.13.12, 5.14.11, 5.14.12, 5.15.11, 5.15.12, 5.16.11, 5.16.12, 5.17.11, 5.17.12, 5.18.11, 5.18.12, 5.19.11, 5.19.12, 5.20.11, 5.20.12, and 6.1 through 6.4
	Land Management—Sections: 1.1, 1.1.1, 1.2.4, 1.2.5, 1.3, 1.3.4, 1.4.1, 1.4.2, 1.4.3, 1.5, 1.6, 1.7, 1.8, 1.9, 2.1, 2.3.3, 2.4.1, 2.4.2, 2.5, 2.6, 2.7, 2.8, 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 4.2 through 4.21, 5.2 through 5.21, and 6.1 through 6.4

TABLE 1-1
COMPONENTS OF THE INRMP FOR THE BMGR REQUIRED BY THE MLWA OF 1999 AND SIKES ACT

Component/Statutory Reference	Location(s) Where Component is Addressed in this EIS
	Wildlife Oriented Recreation—Sections: 1.1, 1.1.1, 1.3, 1.4.1, 1.4.2, 1.4.3, 1.5.2 through 1.5.5, 1.8.1, 1.8.2, 1.9, 1.10, 2.1, 2.6, 2.7, 2.8, 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 4.6, 4.7.3.2, 4.11, 4.12, 4.13, 4.14, 4.19, 5.2.3 through 5.2.9, 5.3.3 through 5.3.9, 5.4.3 through 5.4.9, 5.5.3 through 5.5.9, 5.6.3 through 5.6.9, 5.7.3 through 5.7.9, 5.8.3 through 5.8.9, 5.9.3 through 5.9.9, 5.10.3 through 5.10.9, 5.11.3 through 5.11.9, 5.12, 5.13, 5.14.3 through 5.14.9, 5.15.3 through 5.15.9, 5.16.3 through 5.16.9, 5.17.3 through 5.17.9, 5.18.3 through 5.18.9, 5.19.3 through 5.19.9, 5.20.3 through 5.20.9, and 6.1 through 6.4
17. Provide for "fish and wildlife habitat enhancement or modifications" [16 U.S.C. 670a(b)(1)(B)]	Sections: 1.9, 2.5.1, 3.2, 3.4, 3.6, 4.5.3, 4.6.2, 4.6.3.1, 4.6.3.2, 4.6.3.3, 4.6.3.4, 4.6.4.2, 4.7.3.3, 5.5.7, 5.5.18, 5.6.7, 5.6.11, 5.6.18, 5.7.11, 5.8.11, and 5.11.11
18. Provide for "wetland protection, enhancement, and restoration, where necessary for support of fish, wildlife, or plants" [16 U.S.C. 670a(b)(1)(C)]	Sections: 3.4, 3.6, 4.3.1.4, 4.3.3.1, and 4.6.1.2
19. Provide for *integration of, and consistency among, the various activities conducted under the [INRMP]* [16 U.S.C. 670a(b)(1)(D)]	Sections: 1.1, 1.9, 2.4.3, 2.7, 2.8, 3.1, 3.2, 3.3, 3.4, 4.2.2, 4.3.2, 4.4.2, 4.5.2, 4.6.2, 4.7.2, 4.8.2, 4.9.2, 4.10.2, 4.11.2, 4.12.2, 4.13.2, 4.14.2, 4.15.2, 4.16.2, 4.17.2, 4.18.2, 4.19.2, 4.20.2, 5.2 through 5.21, and 6.1 through 6.4
20. Provide for "establishment of specific natural resource management goals and objectives and time frames for proposed action" [16 U.S.C. 670a(b)(1)(E)]	Sections: 1.1, 1.5.5, 2.7, 2.8, and 3.2
21. Provide for "sustainable use by the public of natural resources to the extent that the use is not inconsistent with the needs of fish and wildlife resources" [16 U.S.C. 670a(b)(1)(F)]	Sections: 1.1, 1.1.1, 1.4.1, 1.4.2, 1.4.3, 1.5.4, 1.5.5, 1.8.1, 1.8.2, 1.9, 2.1, 2.7.3, 3.1, 3.2, 3.4, 3.6, 4.12, 5.2.1, 5.2.3 through 5.2.8, 5.2.18, 5.3.1, 5.3.3 through 5.3.8, 5.3.18, 5.4.1, 5.4.3 through 5.4.8, 5.4.18, 5.5.1, 5.5.3 through 5.5.8, 5.5.18, 5.6.1, 5.6.3 through 5.6.8, 5.6.18, 5.7.1, 5.7.3 through 5.7.8, 5.7.18, 5.8.1, 5.8.3 through 5.8.8, 5.8.18, 5.11.1, 5.11.3 through 5.11.8, 5.11.18, 5.12, 5.16.1, 5.16.3 through 5.16.8, 5.16.18, 5.17.1, 5.17.3 through 5.17.8, 5.17.18, 5.20.1, 5.20.3 through 5.20.8, 5.20.18, and 6.1 through 6.4
22. Provide for "public access to the military installation that is necessary or appropriate for the use described in subparagraph (F) [see Component 21], subject to requirements necessary to ensure safety and military security" [16 U.S.C. 670a(b)(1)(G)]	Sections: 1.1, 1.1.1, 1.4.1, 1.4.2, 1.4.3, 1.5.4, 1.5.5, 1.8.1, 1.8.2, 1.8.3, 1.9, 2.1, 2.2, 2.2.1 through 2.2.9, 2.6, 2.6.1, 3.2, 3.3, 3.4, 3.5, 3.6, 4.12, 4.13, 5.12, 5.13, and 6.1 through 6.4
23. Provide for "enforcement of applicable natural resource laws (including regulations)" [16 U.S.C. 670a(b)(1)(H)]	Sections: 1.9, 2.5.1, 3.4, 3.6, 4.2.3.1, 4.3.3.1, 4.4.3.1, 4.5.3.1, 4.6.3.1, 4.6.3.3, 4.7.3.1, 4.8.3.1, 4.9.3.1, 4.10.3.1, 4.11.3.1, 4.12.3.1, 4.13.3.1, 4.14.3.1, 4.15.3.1, 4.16.3.1, 4.17.3.1, 4.18.3.1, 4.20.3.1, 5.2.5, 5.3.5, 5.4.5, 5.5.5, 5.6.5, 5.6.8, 5.7.5, 5.8.5, 5.11.5, 5.12.5, 5.12.18, 5.13.5, 5.13.18, 5.14, 5.16.5, 5.17.5, and 5.18.5
24. Provide for "no net loss in the capability of military installation lands to support the military mission of the installation" [16 U.S.C. 670a(b)(1)(I)]	Sections: 1.1, 1.1.1, 1.2.1, 1.2.2, 1.2.3, 1.4.1, 1.4.2, 1.4.3, 1.5.4, 2.2, 2.2.1 through 2.2.9, 2.3, 2.7, 3.3, 3.5, 4.2.2, 4.3.2, 4.4.2, 4.5.2, 4.6.2, 4.7.2, 4.8.2, 4.9.2, 4.10.2, 4.11.2, 4.12.2, 4.13.2, 4.14.2, 4.15.2, 4.16.2, 4.17.2, 4.18.2, 4.19.2, and 4.20.2
25. Provide for "such other activities as the Secretary of the military department determines appropriate" [16 U.S.C. 670a(b)(1)(J)]	Sections: 1.2, 2.3, and 3.3

1.1.2. EIS and INRMP Preparers

The lead agencies for preparing this EIS and the ROD include the U.S. Departments of the Air Force, Navy, and Interior; Arizona Game and Fish Department (AGFD) is a cooperating agency. The final INRMP, which will be based on the resource management alternative selected in the ROD, will be jointly prepared by the Departments of the Air Force, Navy, and Interior and AGFD. The responsibilities of these agencies for preparing the EIS and INRMP and implementing the INRMP are summarized in Table 1-2. At the local planning level for the INRMP, the Departments of the Navy and Air Force are represented by the commanding officers of Marine Corps Air Station (MCAS) Yuma and Luke Air Force Base (AFB), respectively. The Department of the Interior is represented locally by the U.S. Fish and Wildlife Service (USFWS) Cabeza Prieta NWR and BLM Phoenix and Yuma field offices. A Core Planning Team composed of representatives from MCAS Yuma, Luke AFB, Cabeza Prieta NWR, BLM Phoenix Field Office, and AGFD was established to guide and coordinate preparation of this EIS and the final INRMP.

1.2 BMGR BACKGROUND

1.2.1 BMGR Renewal

Acquisition of the BMGR for military aviation training purposes began in 1941, shortly before the United States entered World War II. Although the size of the range has fluctuated somewhat over the years, the BMGR has served continuously as a military training range. On 5 September 1999, the BMGR registered its 58th year as one of the nation's finest and most productive reservations for training military aircrews. One month later, on 5 October 1999, Congress reconfirmed the nation's continuing need for this range by passing the MLWA of 1999. This Act extends authorization for the BMGR for 25 years until 2024 and provides that the DoD may apply for an extension to that authorization should there be a continuing military need for the range beyond 2024 [P.L. 106-65 §3031(d) and (e)]. Under the Act, the range lands are withdrawn[1] from all forms of appropriation under the general land laws—including the mining, mineral leasing, and geothermal leasing laws—and are reserved[2] for continued military use [P.L. 106-65 §3031(a)(1) and (2)]. Land jurisdiction over the eastern and western portions of the BMGR is assigned to the Secretaries of the Air Force and Navy, respectively. The eastern portion of the range was designated as Barry M. Goldwater Range—East (BMGR—East) by the MLWA of 1999 and the western portion was designated as Barry M. Goldwater Range—West (BMGR—West).

[1] "Withdrawing" federal lands means to withhold them by executive or legislative action from settlement, sale, location, or entry under some or all of the general land, mining, and mineral laws in order to limit or prohibit activities normally permitted under those laws. The Defense Withdrawal Act of 1958 (P.L. 85-337) provides that an Act of Congress is required for land withdrawals for military purposes that are more than 5,000 acres in aggregate.

[2] "Reserving" federal lands means designating withdrawn areas for specified public (or governmental) purposes or programs. For example, military reservations established in areas formerly a part of the public domain consist of lands that have been withdrawn and then reserved, nearly always in the same executive or legislative action, for the purpose of military use.

TABLE 1-2
AGENCY RESPONSIBILITIES FOR PREPARING THE EIS AND FINAL INRMP AND IMPLEMENTING THE FINAL INRMP

Task	Referenced Authority/Agreement				
	MLWA of 1999	**Sikes Act**	**MLWA Implementation Cooperative Agreement[1]**	**NEPA**	**EIS for the Proposed INRMP and the Final INRMP**
EIS and INRMP Preparation	Secretaries of the Navy, Air Force, and Interior shall jointly prepare the INRMP[2]. INRMP shall be prepared and implemented in accordance with the Sikes Act and provisions of the MLWA[3].	Secretaries of the Navy and Air Force shall prepare the INRMP in cooperation with the Secretary of the Interior, acting through the Director of the USFWS, and the Director of AGFD[4].	Departments of the Navy, Air Force, and Interior and the State of Arizona will jointly prepare and implement an ecosystem-based INRMP[5].	A lead agency shall supervise the preparation of an EIS. Other federal, state, local, or tribal agencies with jurisdiction or special expertise with respect to any environmental issue maybe a cooperating agency upon the request of the lead agency in the preparation of an EIS[6].	Departments of the Navy, Air Force, and Interior are the lead agencies and AGFD is a cooperating agency for preparing this EIS and the ROD, which will identify the alternative selected for the INRMP. These agencies will jointly prepare the final INRMP based on the resource management alternative selected in the ROD.
EIS and INRMP Decisionmaking	Disagreements on contents of the INRMP or its subsequent amendments shall be resolved by the Secretary of the Navy for BMGR—West and the Secretary of the Air Force for BMGR—East, after consultation with the Secretary of the Interior, acting through the Arizona State Director BLM and Regional Director (Region 2) USFWS[7].	Secretaries of the Navy and Air Force but INRMP must also reflect the mutual agreement of the Director of the USFWS, and the Director of AGFD concerning the conservation, protection, and management of wildlife resources[8].	Disagreements on contents of the INRMP shall be resolved by the Secretary of the Air Force for BMGR—East and the Secretary of the Navy for BMGR—West, after consultation with the Secretary of the Interior, acting through the Arizona State Director BLM and Regional Director (Region 2) USFWS and the Governor of Arizona, who may delegate to the Director of AGFD[9].	The lead and cooperating agencies may support the same preferred alternative or identify separate preferred alternatives in the EIS. The lead agency(ies) signs the ROD selecting the preferred alternative. Cooperating agencies may provide a letter concurring with or objecting to that selection; or cooperating agencies with jurisdiction by law may prepare their own ROD selecting a different environmentally preferred alternative[10].	Secretaries of the Navy, Air Force, and Interior will sign the ROD for the EIS selecting the preferred resource management alternative for the INRMP. AGFD may concur with or object to that selection. Secretaries of the Navy, Air Force, and Interior and the Director of AGFD will sign the INRMP, which must reflect their mutual agreement concerning the conservation, protection, and management of wildlife resources.

TABLE 1-2
AGENCY RESPONSIBILITIES FOR PREPARING THE EIS AND FINAL INRMP AND IMPLEMENTING THE FINAL INRMP

Task	Referenced Authority/Agreement				
	MLWA of 1999	**Sikes Act**	**MLWA Implementation Cooperative Agreement[1]**	**NEPA**	**EIS for the Proposed INRMP and the Final INRMP**
INRMP Review and Amendment	The INRMP shall include procedures to ensure that the periodic reviews of the plan under the Sikes Act are conducted jointly by the Secretaries of the Navy, Air Force, and Interior, and that affected States [Arizona] and Indian tribes, and the public, are provided with a meaningful opportunity to comment upon any substantial revisions to the plan that may be proposed[11].	The INRMP must be reviewed as to operation and effect by the Secretaries of the Navy and Air Force in cooperation with the Secretary of the Interior, acting through the Director of the USFWS, and the Director of AGFD on a regular basis, but not less often than every five years[12].	Cooperative Agreement parties will meet as needed to develop, review, and implement the INRMP[13].	Proposed INRMP amendments will be reviewed under the NEPA as applicable pursuant to 40 CFR § 1501.2, 1501.3, 1501.4, 1502.25, and 1508.18.	Section 1.4.4 of the EIS expresses the intent of the Marine Corps, Air Force, USFWS, and AGFD to review the INRMP, and amend it as necessary, at a minimum of five-year intervals, or as required.

TABLE 1-2
AGENCY RESPONSIBILITIES FOR PREPARING THE EIS AND FINAL INRMP AND IMPLEMENTING THE FINAL INRMP

Task	Referenced Authority/Agreement				
	MLWA of 1999	**Sikes Act**	**MLWA Implementation Cooperative Agreement[1]**	**NEPA**	**EIS for the Proposed INRMP and the Final INRMP**
INRMP Public Report Preparation	Concurrent with each review of the INRMP, the Secretaries of the Navy, Air Force, and Interior shall jointly prepare a public report describing changes in the conditions of the BMGR, including current military use of the range, changes in military use since the previous report, and efforts related to the management of natural and cultural resources and environmental remediation during the previous five years. Before the report is finalized, the Secretaries shall invite interested members of the public to review and comment on the report, and shall hold at least one public meeting concerning the report[14].	Not applicable to Sikes Act requirements.	Cooperative Agreement parties will prepare and issue a report every five years describing changes in the condition of the lands withdrawn and reserved for the BMGR. The report shall include a summary of current and future military use, any changes in military use since the previous report, and efforts related to the management of natural and cultural resources and environmental remediation. Interested members of the public will be invited to review and comment on the report; at least one public meeting concerning the report will be held[15]. The Secretaries of the Air Force and Navy shall resolve any disagreements concerning the contents of the 5-year reports[16].	Not applicable to NEPA requirements.	Section 1.4.4 of the EIS expresses the intent of the Marine Corps, Air Force, USFWS, and AGFD to prepare and issue the public report specified in the MLWA of 1999 at five-year intervals.

TABLE 1-2
AGENCY RESPONSIBILITIES FOR PREPARING THE EIS AND FINAL INRMP AND IMPLEMENTING THE FINAL INRMP

Task	Referenced Authority/Agreement				
	MLWA of 1999	Sikes Act	MLWA Implementation Cooperative Agreement[1]	NEPA	EIS for the Proposed INRMP and the Final INRMP

[1] Cooperative Agreement, dated January 2001, by and between the Departments of the Air Force, Navy, and Interior and the State of Arizona to implement MLWA of 1999 at the BMGR
[2] P.L. 106-65 Section 3031(b)(3)(A)
[3] P.L. 106-65 Section 3031(b)(3)(D)
[4] 16 U.S.C 670a (a)(2)
[5] Cooperative Agreement Section V.1.
[6] 40 CFR §1501.5, 1501.6, 1508.5, and 1508.16
[7] P.L. 106-65 Section 3031(b)(3)(C)
[8] 16 U.S.C. 670a (a)(2)
[9] Cooperative Agreement Section VII.1.
[10] 40 Questions & Answers About CEQ Regulations (14b)
[11] P.L. 106-65 Section 3031(b)(3)(E)(ix)
[12] 16 U.S.C. 670a (b)(2)
[13] Cooperative Agreement Section V.1.e
[14] P.L. 106-65 Section 3031(b)(5)
[15] Cooperative Agreement Section V.1.b
[16] Cooperative Agreement Section VII.2.

The division between BMGR—East and BMGR—West is defined by the roughly north-south boundary separating restricted airspaces[3] R-2301E and R-2301W (Figure 1-1).

1.2.2 BMGR Regional Setting

The BMGR was first established in 1941 and, although the range has varied slightly in area over the years with subsequent land withdrawals and deletions, it generally encompassed about 2.7 million acres until the MLWA of 1999 reduced the land area of the BMGR to 1,733,921 acres (2,709 square miles) (see Figure 1-1). The BMGR is undeveloped and uninhabited because safety requirements of the military training mission conducted on the range restrict both habitation and economic development of the range and specify that public visitation be directly controlled. Nearby communities include Yuma, Wellton, Tacna, Gila Bend, Ajo, and additional neighboring rural communities in Arizona, and San Luis Rio Colorado and Sonoyta in Mexico; all of these communities have been experiencing recent steady increases in population.

Although the land area was reduced by the MLWA of 1999, the capabilities and capacity of the BMGR to support military operations were unaffected. The non-renewed parcels were either unnecessary for continuing or projected military purposes, or mechanisms other than land withdrawal were identified to further the limited military mission support roles of the affected parcels. Overlying restricted airspace that supports military operations at the BMGR was unaffected by the MLWA of 1999. Four contiguous restricted airspace areas (R-2301W, R-2301E, R-2304, and R-2305) overlie almost the entire land area of the BMGR and some adjacent lands, including the Cabeza Prieta NWR (see Figure 1-1).

1.2.3 Military Purposes of the BMGR

The predominant use of the BMGR throughout its history has been to provide land and airspace for air combat training. The MLWA of 1999 continues the historic military purposes of the range. This Act reserves the BMGR for use by the Secretaries of the Air Force and Navy for:

- an armament and high-hazard testing area
- training for aerial gunnery, rocketry, electronic warfare, and tactical maneuvering and air support
- equipment and tactics development and testing; and other defense-related purposes consistent with those specified in this paragraph [P.L. 106-65 §3031(a)(2)]

[3] Restricted airspace is designated by the Federal Aviation Administration to denote airspace areas where military activities (such as aerial gunnery, artillery firing, or missile firings) can occur. Restricted areas are depicted on aeronautical charts to alert the crews of aircraft not participating in restricted airspace activities of the potential presence of such hazards. The Federal Aviation Administration delegates control of restricted airspace to the using military agency.

For the Air Force, Marine Corps, Navy, Air National Guard, Army National Guard, and Air Force Reserve, the BMGR is an essential component of the national defense training base that is indispensable to their abilities to produce the combat-ready aircrews[4] needed to defend the nation and its interests. The BMGR has been one of the nation's most productive military reservations for training tactical aircrews since World War II. As the nation's third largest military reservation[5], the BMGR has the training capabilities, capacities, and military air base support that provide the flexibility needed to sustain a major share of the country's aircrew training requirements now as well as into the foreseeable future. The value of the BMGR for supporting high-quality aircrew training stems from a combination of the following attributes:

- Restricted land and airspace allows military activities that may be hazardous to either non-participating air traffic or ground surface users to occur without exposing the public or military personnel to undue safety risks and without interruption.

- The extensive land and airspace size has allowed the range to be partitioned into up to nine subranges to support multiple independent training activities simultaneously or used to support large-scale range-wide exercises.

- Ten nearby supporting air bases[6] provide the technical, academic, material, command and control, maintenance, personnel, and community support needed to keep aircraft and aircrews flying.

- Electronic training instrumentation on the range can be used to observe, measure, record, and replay the simultaneous actions of multiple aircraft participating in training activities and can simulate aircraft weapons use as well as enemy missile threats.

- Nearby supporting military airspace provides airborne staging areas for BMGR training activities and relieves BMGR airspace of the need to support lower priority training operations.

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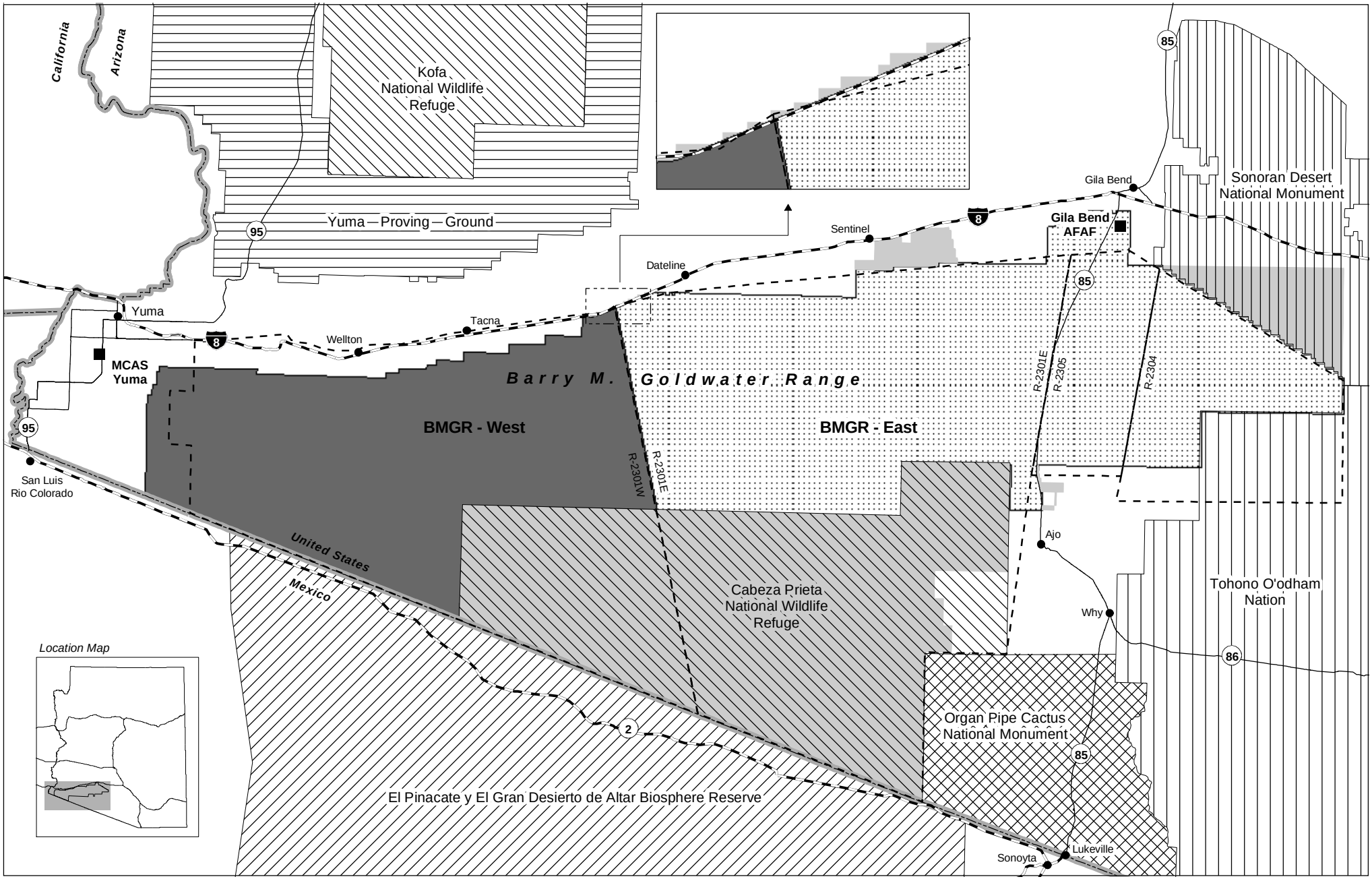
4 Aircrew refers to the crew members who operate an aircraft or its various systems. Single-seat fighter or attack aircraft, such as the F-16C or A-10, have one crew member—the pilot. Twin-seat fighter or attack aircraft—such as the F-14, F-15E, or AH-64 (an attack helicopter)—carry a weapons systems officer in addition to the pilot. Transport aircraft—such as the C-130, CH-53 (a helicopter), or UH-60 (a helicopter)—are operated by a pilot, copilot navigator, load master, and other types of crew members. All aircrew members participate in training operations.

5 The Nellis Test and Training Range in Nevada is the nation's largest military range with 2,919,890 acres (4,562 square miles) withdrawn by the MLWA of 1999. The second largest is the Army's White Sands Missile Range in New Mexico, which encompasses about 2,050,000 acres (3,200 square miles).

6 Supporting air bases include MCAS Yuma, Luke AFB, Davis-Monthan AFB, Arizona Air National Guard Base, Papago Army Heliport, Silverbell Army Heliport, Naval Air Facility El Centro, MCAS Miramar, MCAS Camp Pendleton, and NAS North Island.



N

0 5 10 15 20

Scale in Miles

Legend

- Restricted Airspace Boundary
- State Routes and other Highways
- U.S. Interstate and Mexico Federal Highways
- BMGR - West
- BMGR - East
- Former BMGR Parcels not Renewed by the MLWA of 1999

BMGR Land Area as Renewed by the MLWA of 1999

Figure 1-1

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- Year-round flying weather allows most training activities to be efficiently performed as planned without weather delays.

- Varied natural terrain adds realism to target simulations and the flight training experience.

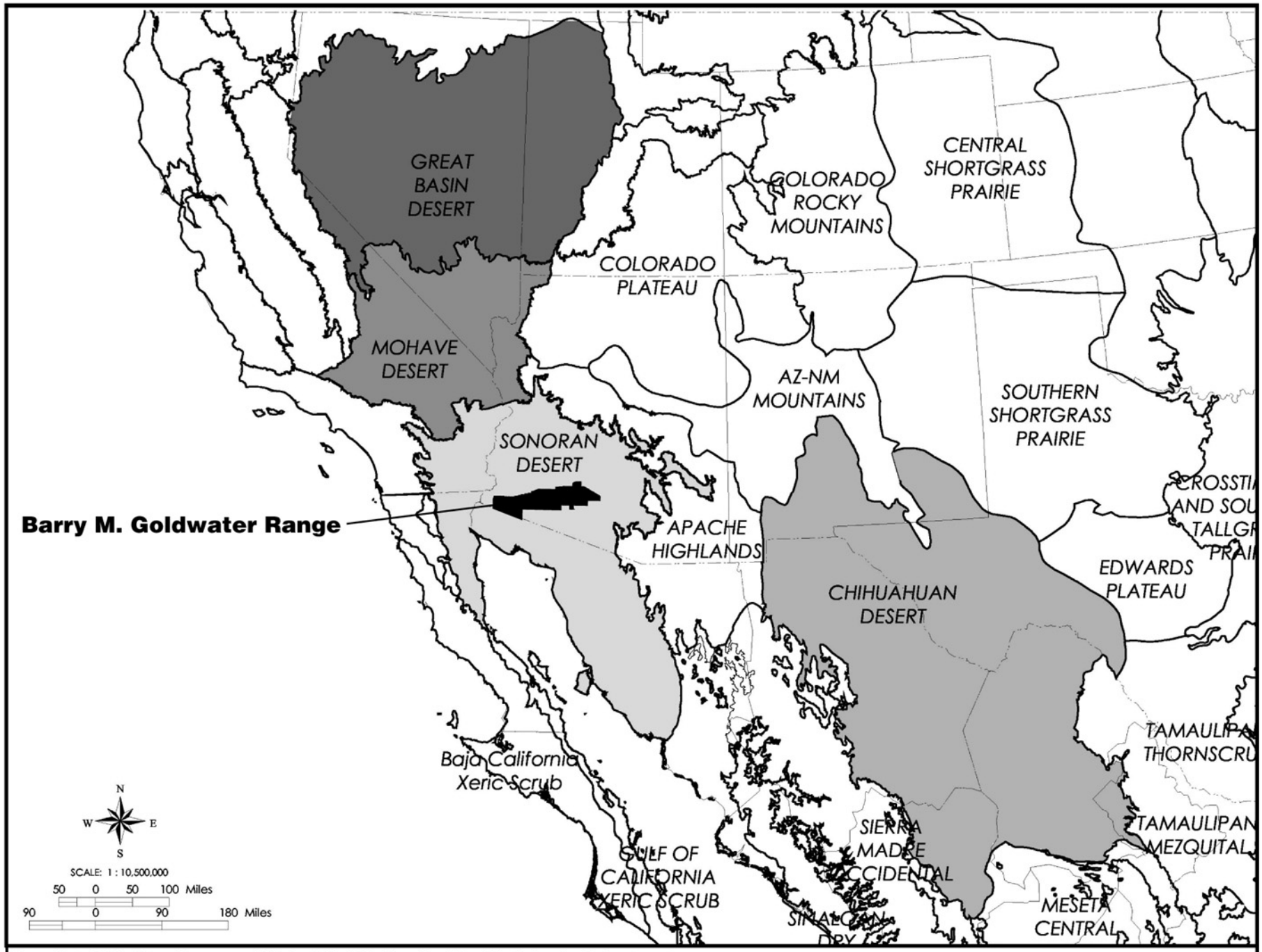
These military purposes are examined in detail in the legislative EIS (LEIS) for renewal of the BMGR land withdrawal (U.S. Air Force 1999).[7]

1.2.4 Ecological Significance of the BMGR

Parallel to its continuing value as an essential national defense asset, the BMGR is also nationally important as a critical component in the largest remaining tract of relatively unfragmented Sonoran Desert in the United States. Composed of the BMGR, Cabeza Prieta NWR, Organ Pipe Cactus NM, Sonoran Desert NM, and BLM Sentinel Plain area, this tract currently totals about 5,000 square miles of which the range contributes almost 55 percent of the land area. The BMGR is important because it encompasses significant east to west ecological gradients that define the interface between the Arizona Upland and Lower Colorado River Valley subdivisions of the Sonoran Desert. The eastern extent of the range harbors some of the most extensive and healthy saguaro cactus-mixed cactus-paloverde forests in the Arizona Upland Subdivision while its western extreme 130 miles away is within the dune fields of the Gran Desierto, which lies around the head of the Gulf of California. The BMGR incorporates much of the diversity of landforms, rainfall, and elevation gradients that are present within the Sonoran Desert in Arizona and that contribute to the biodiversity of this ecoregion (Hall and others 2001). The BMGR is unique for its size and management status. When coupled with the adjacent areas of Organ Pipe Cactus NM, Cabeza Prieta NWR, Sonoran Desert NM and other BLM-administered lands, and the extreme northwestern and western portions of the Tohono O'odham Nation, the BMGR is a key component in one of the largest intact, relatively undisturbed ecosystems in the contiguous United States. At over 1.7 million acres, the BMGR is more than twice the size of any other component in this contiguous complex.

The Sonoran Desert Ecoregion encompasses 55 million acres (almost 86,000 square miles) in southern Arizona, southeastern California, Baja California, and northwestern Sonora (Figure 1-2). It is the most tropical of the three North American warm deserts (Chihuahuan, Mojave, and Sonoran) and displays the greatest numbers of plant communities. The ecoregion is especially rich in biological diversity and, as a result, was identified by researchers at the World Wildlife

[7] The LEIS for the renewal of the BMGR land withdrawal as well as other documents incorporated in this EIS by reference are available for public review upon request. Such requests should be directed to the information contacts listed on the cover sheet, located just before the table of contents.



Source Data: ① The Nature Conservancy. ② Bailey, R.G. 1998. Ecoregions Map of North America: Explanatory note. Misc. Publ. 1548. U.S. Department of Agriculture, Forest Service. Washington, DC. 10 p.
Dinerstein E., D.M. Olson, D.J. Graham, A.L. Webster, S.A. Primm, M.P. Bokkbinder, and G. Ledec. 1995. A conservation assessment of the terrestrial ecoregions of Latin America and the Caribbean. The World Bank, Washington, D.C.

Sonoran Desert Ecoregion

Figure 1-2

Fund as one of the top 233 ecoregions worldwide that deserved special conservation attention (Olson and Dinerstein 1998). In an ecological analysis of conservation priorities within the Sonoran Desert Ecoregion, the BMGR was within two of the landscape-scale conservation sites identified as conservation priorities (Marshall and others 2000). The Sonoran Desert harbors a high proportion of endemic plants, reptiles, and fish. More than 2,500 pollinator species have been documented (invertebrates, birds, and bats), including the highest known diversity of bee species in the world (Phillips and Wentworth Comus 2000). More than 500 bird species migrate through, breed, or permanently reside in the ecoregion—nearly two-thirds of all species that occur in northern Mexico, the United States, and Canada combined. The largest dune system in North America, the Gran Desierto, is contained within the Sonoran Desert and, as noted, is represented within the BMGR.

While the native biological species of the Sonoran Desert are well adapted to its extreme conditions and generally form robust communities within the BMGR, the Sonoran Desert is also vulnerable to physical disturbance and biological invasion. In many respects, its biodiversity is under siege. Since the end of World War II, the Sunbelt of the American Southwest and Northwest Mexico has been the setting for the largest in-migration in human history (Nabhan and Holdsworth 1999). In 1990, the Sonoran Desert Ecoregion contained 6.9 million residents, nearly double the population size in 1970. The population is expected to reach 12 million by 2020. Under such human growth pressure, the threats to Sonoran Desert biodiversity reported by Nabhan and Holdsworth (1999) will likely become more severe. Marshall and others (2000) report that the Sonoran Desert's biodiversity has historically been and, in some cases, continues to be threatened by conversion of natural habitat to urban, suburban, and agricultural areas; overuse of natural surface- and ground-water resources; increasing recreational use of the desert; historic grazing; and the spread of exotic, invasive plants and animals. Illegal border activities pose an additional threat as border crossings and associated law enforcement activities have increased in recent years. These actions may collectively result in ecosystem degradation and habitat loss leading to the decline or extirpation of some species.

In large part, the ecological health of the BMGR has been maintained or restored over the last 60 years because: (1) most land uses that would be severely disruptive to the environment have been excluded from the range in order to protect the safety of the public and military personnel and to prevent disruption of the military training operations; and (2) only a small percentage of the restricted land area is disturbed by military training activities. Safety requirements restrict both habitation and economic development of the range and specify that public visitation be directly controlled. Activities such as livestock grazing; mining; agricultural crop production; and residential, commercial, or industrial development—which have caused substantial ecological damage elsewhere within the BMGR region—have been legally excluded from the range since the World War II era. Some recreational use has been permitted where it is compatible with the safety requirements of the military mission, but most recreation activity has historically been dispersed and of low intensity in contrast to that experienced in some nearby off-range locations.

Military activities have, of course, had some localized deleterious effects on the range environment. However, after six decades of military use, only about 2.5 percent of the current BMGR surface has been moderately to highly disturbed by these activities. Another 7.5 percent of the range surface has experienced low to moderate levels of disturbance.[8] Notably, military surface use has been distributed in such a way that most disturbance effects are widely scattered and native biological communities are generally unfragmented over the expanse of the BMGR. In other words, the long-standing withdrawal of the range for military purposes has had the side benefit of generally allowing natural processes to continue to dominate the course of the ecological landscape. As direct evidence of the ecological health of the range, all of the native wildlife species believed to be present when military use began in 1941 are also believed to still be present (U.S. Air Force 1999). In essence, the biological diversity of the range is believed to be undiminished from the levels present before the military range was established.

1.2.5 Cultural Resource Significance of the BMGR

The same factors that have helped to preserve the ecological resources of the BMGR—exclusion of surface disturbing, non-military land uses and limited land disturbance by military activities—have also helped to protect cultural resources. As a result, well-preserved cultural remains within the BMGR provide a remarkable record of thousands of years of human habitation and use. These remains include sites and features such as prehistoric-period artifact scatters, clusters of fire-cracked rock, sleeping circles, intaglios or geoglyphs, rock art, rock shelters, rock cairns and shrines, large habitation and use sites and historic-period mines and smelters, ranches, and military training facilities (dating from World War II). Cultural resource inventories, conducted to date by the Air Force and Marine Corps principally within areas directly affected by military activities, have identified more than 1,200 archaeological sites and other cultural resource features. In addition to their archaeological value, many of these places and features are culturally significant to Native American tribes.

The interpretive significance of the archaeological record within the BMGR is greater than that of any of its individual features. The true significance of this record lies in the fact that the relatively undisturbed landscape of the range still harbors evidence of the aggregate spectrum of human activities that took place here through time. Both small and large sites—from individual prehistoric stone-working areas to village sites or individual historic mining prospects to well-developed mine complexes—are important components of this mosaic, and the loss of any individual component diminishes the ability of archaeologists and anthropologists to understand and interpret the whole. In addition, most tribes attach cultural significance to archaeological

[8] Because the MLWA of 1999 reduced the size of the BMGR by 934,179 acres, the percentage of surface disturbance is now higher than that reported in the Final LEIS for the renewal of the BMGR land withdrawal (U.S. Air Force 1999).

sites and consider the loss of even one small site an adverse effect that should be avoided. The Air Force and Marine Corps are responsible for protecting and managing the cultural resources within the BMGR in accordance with a suite of federal laws and regulations.

1.3 NATURAL AND CULTURAL RESOURCES MANAGEMENT RESPONSIBILITIES

Primary responsibilities for the management of natural resources within the BMGR fall within the purviews of three federal agencies and one state agency—Air Force, Marine Corps, USFWS, and AGFD. The Air Force and Marine Corps also have the primary responsibilities for the management of cultural resources within the range. A fifth agency, BLM, has reserve oversight roles but no direct resource management responsibilities. Pursuant to the MLWA of 1999, jurisdiction over land and interests in the lands of the BMGR were transferred from the Secretary of the Interior to the Secretaries of the Navy and Air Force for BMGR—West and BMGR—East, respectively [P.L. 106-65 §3031(a)(1) and (2)]. Surface management responsibility for the range lands, and hence natural and cultural resources, had been assigned to the Secretary of the Interior under the most recent previous Congressional authorization for the BMGR, the MLWA of 1986, [P.L. 99-606]. The current primary responsibilities for both properly managing and protecting the natural and cultural resources of the range and for using the range to support national defense purposes within its respective west and east subdivisions have been assigned to the Marine Corps and Air Force [P.L. 106-65 §3031(a)(1) and (2) and §3031(b)].

The Secretary of the Interior remains involved in the management of natural and cultural resources within the BMGR by virtue of provisions of the MLWA of 1999 and Sikes Act. The MLWA of 1999 [P.L. 106-65 §3031(b)(3)(A), (D), and (E)] directs the Secretaries of the Navy, Air Force, and Interior to jointly prepare an INRMP for the BMGR in accordance with the Sikes Act. In addition, the Sikes Act states:

> The Secretary of a military department shall prepare each integrated natural resources management plan for which the Secretary is responsible in cooperation with the Secretary of the Interior, acting through the Director of the United States Fish and Wildlife Service, and the head of each appropriate State fish and wildlife agency for the State in which the military installation concerned is located [16 U.S.C. 670a (a)(2)].

This provision of the Sikes Act clarifies that the Director of the USFWS is the approval and management oversight authority representing the Secretary of the Interior in the preparation and implementation of the INRMP [see also Secretary of the Interior's Order 3222, Section 3(a)]. As stated, the Sikes Act also provides that each INRMP is to be prepared in cooperation with the head of the state fish and wildlife agency in the state in which the installation is located. The

Sikes Act further stipulates that the INRMP "…shall reflect the mutual agreement of these parties concerning the conservation, protection, and management of wildlife resources" [16 U.S.C. 670a (a)(2)].

Nothing in the MLWA of 1999 either expands or diminishes the primary jurisdiction over resident wildlife management within the BMGR that is held by the State of Arizona. Primary jurisdiction for resident wildlife management is implemented on behalf of the State by the AGFD, except where pre-empted by federal law. In addition, AGFD is responsible for providing safe off-highway vehicle recreation for the State. The MLWA of 1999 also does not modify the responsibilities of the USFWS for administering compliance with the Endangered Species Act (ESA) of 1973 [16 U.S.C. 1531 et seq.] and Migratory Bird Treaty Act (MBTA) of 1918 [16 U.S.C. 703 et seq.] within the BMGR.

Participation by the BLM in the development of the INRMP for the BMGR is advantageous. Prior to November 2001, the BLM Phoenix and Yuma field offices served as the primary surface managers for BMGR—East and BMGR—West, under the MLWA of 1986. This tenure represents the most recent 15 years of primary land management experience with the range. The BLM will also continue to serve limited roles with the BMGR under provisions of the MLWA of 1999, including (1) consulting in the resolution of disagreements on the contents of the INRMP or its subsequent amendments, (2) resuming management of BMGR lands should resource management authority be returned to the Secretary of the Interior under terms provided by the MLWA of 1999, and (3) consulting on any non-emergency closures of the range that are not specified in the forthcoming INRMP [P.L. 106-65 §3031(b)(3)(C), §3031(b)(1)(C) and (b)(7), and §3031(b)(2)(C), respectively]. The dispute resolution responsibility of the Secretary of the Interior is limited to consultation. The MLWA of 1999 provides that:

> Any disagreement concerning the contents of [the INRMP], or any subsequent amendments to the plan, shall be resolved by the Secretary of the Navy for the West Range and the Secretary of the Air Force for the East Range, after consultation with the Secretary of the Interior through the State Director, Bureau of Land Management and, as appropriate, the Regional Director, United States Fish and Wildlife Service [P.L. 106-65 §3031(b)(3)(C)].

The State of Arizona would also have a consultation role in resolving disputes about the contents of the INRMP in accordance with the Cooperative Agreement among the U.S. Departments of the Air Force, Navy, and Interior and the State of Arizona for the implementation of the MLWA of 1999. The Cooperative Agreement includes a provision that states:

> Any disagreements concerning the contents of the INRMP shall be resolved by the Secretary of the Air Force for the East Range and the Secretary of the Navy for the West Range, after consultation with the Secretary of the Interior through

> the State Director, BLM, and, the Regional Director, [USFWS], and the Governor of the State, who may delegate to the Director, AGFD… [Cooperative Agreement Section VII.1.]

The resumption of BLM management of the BMGR would only occur if the Secretary of the Interior determines, through written notice, that the Air Force and Marine Corps had failed to manage the withdrawn lands in accordance with the INRMP and only if such failure is resulting in significant and verifiable degradation of natural and cultural resources and the Secretaries of the Air Force and Navy fail to correct the management deficiencies identified by the Secretary of the Interior in his written notice [P.L. 106-65 §3031(b)(7)].

The Secretaries of the Air Force and Navy are ultimately accountable for the implementation of the INRMP; however, the mutual intent of the agencies participating in the preparation of this EIS and subsequent final INRMP document is to support development and implementation of the INRMP through continuing cooperative efforts that are facilitated by ongoing public involvement programs. The Secretary of the Air Force has delegated local command and control for BMGR—East and preparation of the range INRMP to the Commander of the 56th Fighter Wing (FW) at Luke AFB. Similarly, the Secretary of the Navy has delegated local command and control for BMGR—West and preparation of the range INRMP to the Commanding Officer of MCAS Yuma.

In reserving BMGR—West for use by the Secretary of the Navy (who, in turn, delegated authority for the use and management of the range to the Marine Corps) and BMGR—East for use by the Secretary of the Air Force, the MLWA of 1999 technically created two contiguous ranges that are administered through separate military departments and chains of command within DoD. These administrative partitions reflect the long-standing patterns of military use at the range that are well-suited to the needs of the Air Force and Marine Corps. The Air Force has been the primary user of BMGR—East since 1941 and Marine Corps has been the primary user of BMGR—West since 1959. Although both the Air Force and Marine Corps make periodic use of the portion of the range that is not under their direct administrative control, the prognosis for the foreseeable future is that the Air Force and Marine Corps will continue to use BMGR—East and BMGR—West, respectively, as their primary areas for training operations.

The MLWA of 1999 includes two geographic options for preparing the INRMP for the BMGR [P.L. 106-65 §3031(b)(3)(A) and (B)]. The Act provides that a single INRMP may be prepared that addresses natural and cultural resources management for the entire range or may be prepared as two individual INRMPs that address the management of BMGR—West and BMGR—East separately. The Secretaries of the Navy, Air Force, and Interior, in cooperation with AGFD, have determined that effective management of the range will be best served by a single INRMP that is applicable to the entire range. Joint preparation of the INRMP by the Air Force, Marine Corps, BLM, USFWS, and AGFD expresses the commitment of these agencies not to fragment

management of the BMGR ecosystem. The forthcoming INRMP will be applicable to the entire BMGR.

The MLWA of 1999 provides that the Secretaries of the Navy and the Air Force may enter into Memorandums of Understanding (MOUs) or Cooperative Agreements with the Secretary of the Interior or other appropriate federal, state, or local agencies, Indian tribes, or other public or private organizations or institutions for purposes of facilitating implementation of the INRMP should they find that such agreements would be favorable for facilitating management of the BMGR [P.L. 106-65 §3031(b)(4)(A)]. Pursuant to this provision of the MLWA of 1999, the Cooperative Agreement among the U.S. Departments of the Air Force, Navy, and Interior and the State of Arizona was placed in effect in January 2001 to facilitate joint preparation and implementation of an ecosystem-based INRMP for the BMGR by the parties to the agreement (see Table 1-2). This agreement neither adds to nor detracts from the individual agency responsibilities and authorities that have been assigned by the MLWA of 1999, Sikes Act, or other applicable law. Rather, the purpose of this agreement is to provide a framework for the Air Force, Navy (Marine Corps), Department of the Interior, and State of Arizona to work cooperatively in the implementation of the provisions of the MLWA of 1999.

In addition to the aforementioned Cooperative Agreement, a previously existing MOU that established the Barry M. Goldwater Range Executive Council (BEC) was amended, in accordance with the MLWA of 1999, in February 2001 for the purpose of "...providing a forum for collaboration by the statutory decisionmakers in the management of resources and their uses..." within the BMGR. The BEC was first formed in 1997 by the Air Force, Marine Corps, BLM, USFWS, and AGFD at the local management level as an informal ad hoc committee designed to facilitate better collaborative management of BMGR resources. The BEC was formally established in March 1998 through an MOU among the member agencies. The membership of the BEC was expanded, through the amended February 2001 MOU, to include the U.S. Border Patrol, and National Park Service (NPS) in addition to the original five members. The council membership consists of the senior functional manager of each agency's local unit(s). No single agency serves as the council lead. Rather, the organization operates to exchange information and provide recommendations to the agencies with primary responsibility for the particular needed action. These recommendations are intended to integrate long-term management plans across jurisdictional and administrative boundaries. Once the proposed INRMP is implemented, the BEC will also provide a forum for involved agencies to discuss adaptive management proposals in accordance with the provisions of the plan.

The MLWA of 1999 includes two additional provisions that require the extension of an existing MOU pertaining to military use of the Cabeza Prieta NWR and the development of a new MOU to establish an intergovernmental executive committee (IEC). Pursuant to Section 3032(c) of the Act, the Secretaries of the Interior, Navy, and Air Force must extend the 1994 MOU, which supports continued military aviation training use of the Cabeza Prieta NWR, for the duration of

the current withdrawal and reservation of the BMGR, which will expire on 5 October 2024. This MOU, however, does not affect natural or cultural resources management of the BMGR.

The IEC was to be established by the Secretaries of the Navy, Air Force, and Interior to provide a forum solely for the purpose of exchanging views, information, and advice relating to the management of the natural and cultural resources within the BMGR [P.L. 106-65 §3031(b)(6)]. The MOU establishing the IEC was placed in effect in December 2001 by Luke AFB, MCAS Yuma, and the USFWS as directed by the Secretaries of the Navy, Air Force, and Interior. Membership in the IEC is limited to those agencies (federal, state, and local) and Native American tribes that may have a direct responsibility for, potential impact upon, or direct interest in the lands or resources of the BMGR. The membership is comprised of selected representatives from interested federal agencies, as well as at least one elected officer (or other authorized representatives) from state government and from each local and tribal government as designated at the discretion of the Secretaries of the Navy, Air Force, and Interior. IEC meetings, which occur at least once every four months, are open to the public and provide non-IEC participants with periodic opportunities to present opinions regarding BMGR management policies and procedures to the IEC for discussion and possible action recommendations. The IEC meetings replaced the BMGR Partners meetings that previously served as a regularly scheduled forum for inter-governmental information exchange and ongoing public involvement pertaining to the management of natural and cultural resources within the BMGR. The IEC would also provide a forum for discussing proposed adaptive management provisions following implementation of the proposed INRMP.

The Navy/Marine Corps and Air Force are required to assume all costs for implementing the INRMP for the BMGR and will execute the plan subject to the availability of funds. This financial responsibility includes paying the Department of the Interior for costs incurred in providing goods or services on behalf of the Navy/Marine Corps or Air Force to assist in the implementation of the INRMP [P.L. 106-65 §3031(b)(8)].

1.4 PURPOSE OF AND NEED FOR THE PROPOSED INRMP

1.4.1 Purpose of the Proposed INRMP

The multifaceted purposes of the proposed INRMP are established by the MLWA of 1999 and Sikes Act. In accordance with the MLWA of 1999, the purposes of the INRMP are to provide for the:

> … proper management and protection of the natural and cultural resources of [the range], and for sustainable use by the public of such resources to the extent

> consistent with the military purposes [of the range]… [P.L. 106-65 §3031(b)(3)(E)(i)].

The purposes of the natural resource management program that would be established under the Sikes Act are closely analogous to those specified in the MLWA of 1999. The Sikes Act provides that:

> Consistent with the use of military installations to ensure the preparedness of the Armed Forces, the Secretaries of the military departments shall carry out [a natural resources management program] to provide for—
>
> (A) the conservation and rehabilitation of natural resources on military installations;
> (B) the sustainable multipurpose use of the resources, which shall include hunting, fishing, trapping and non-consumptive uses; and
> (C) subject to safety requirements and military security, public access to [the BMGR] to facilitate the use [16 U.S.C. 670a (a)(3)].

1.4.2 Need for the Proposed INRMP

The proposed INRMP is needed to comply with the provisions of the MLWA of 1999 and Sikes Act that require that an INRMP be prepared for the BMGR. Beyond these direct statutory requirements, development of a new management plan is also warranted to address changes in current and future military mission requirements, DoD management policies, and BMGR resource and public use conditions that have occurred since the most recent previous resource management plan was prepared for the range. The most recent resource management plan for the range is the Lower Gila South Resource Management Plan (RMP) Goldwater Amendment (hereafter Goldwater Amendment) that was prepared by the BLM. The Goldwater Amendment, which was placed into effect in 1990, was prepared under the purviews of the MLWA of 1986 and the Federal Land Policy Management Act (FLPMA) of 1976 (43 U.S.C. 1701 et seq.). The Goldwater Amendment is based on management planning and environmental assessments that were completed during the early to late 1980s. The key needs that the proposed INRMP resource management program must address include:

- ***A resource management program based on the current conditions and knowledge of BMGR resources and resource uses.*** The proposed INRMP must consolidate, update, and summarize useful and relevant plans, documents, and data, and provide a single comprehensive source of up-to-date information pertinent to natural and cultural resource management on the BMGR. The proposed INRMP must also appropriately support the current and anticipated requirements of: (1) the military mission; (2) natural and cultural

resource protection, conservation, and rehabilitation; and (3) sustainable multipurpose public use.

- ***A resource management program that reflects current and future military mission requirements and the current and anticipated needs and activities of non-military agencies***. There have been some changes in military land use and safety and security requirements within the BMGR since the Goldwater Amendment was prepared. In addition, some future changes in these requirements can be anticipated. Past and emerging changes in nonmilitary agency missions and land use activities are also relevant to the future management of natural and cultural resources within the range. The proposed INRMP needs to accurately reflect these mission requirements and land-use patterns.

- ***Resources management based on ecosystem management and protection of biological diversity.*** DoD has shifted its land management focus over about the last 10 years from protection of individual species to ecosystem management. The two principal reasons for this shift are (1) the emphasis of the Sikes Act on promoting effective wildlife and habitat protection, conservation, and management, and (2) a concern that management attention in the past was disproportionately placed on managing the needs of individual high-profile species to the possible expense of underlying ecosystem functions. It is now the policy of DoD that its lands should be administered through an ecosystem management approach implemented through installation INRMPs. The goal of DoD ecosystem management is to maintain and improve the sustainability and native biological diversity of ecosystems while supporting human needs, including the DoD mission. This goal is reflected in DoD Instruction 4715.3, Environmental Conservation Program; AFI 32-7064, Integrated Natural Resources Management; and Marine Corps Order P5090.2A, Environmental Compliance and Protection Manual. Ecosystem management and protection of biological diversity must consequently be important guiding elements of the BMGR INRMP.

- ***A framework for adapting management to changing conditions.*** Ecosystems are recognized as open, changing, and complex systems. Managing the BMGR ecosystem through the INRMP requires the flexibility to adapt to changing military mission requirements, changing ecosystem conditions, and emerging information about the ecosystem. MLWA of 1999 and Sikes Act requirements to support sustainable multipurpose public use of the range, consistent with the military mission of the BMGR, also require that management tools be in place that can readily regulate public access to reflect changes in military activities or resource management requirements.

- ***A framework for promoting continued interagency management cooperation/collaboration.*** The proposed INRMP must continue the practice of working

across administrative boundaries through the BEC, the IEC, and other perimeter land use and encroachment programs.

- ***A framework for promoting continued effective ongoing public involvement.*** The proposed INRMP must continue to provide a means for the public to be involved in and have a meaningful opportunity to comment on plan amendments and ongoing management activities and public access opportunities.

1.4.3 Decision to be Made and the Decision Makers

This EIS supports agency decision making regarding the selection of a resource management program that will best fulfill the statutory missions and responsibilities of the decision-making agencies, and that will properly protect, conserve, and rehabilitate the natural and cultural resources of the BMGR and provide for sustainable multipurpose public use. The provisions of the selected resources management program must also support and sustain the requirements of the military mission of the range with no net loss in the capability of BMGR lands to support that mission. Public use of the BMGR must be consistent with the military purposes of the range including safety and security requirements.

Five alternative management strategies for protecting, conserving, and rehabilitating the natural and cultural resources of the BMGR and for providing opportunities for sustainable multipurpose public use are addressed in this EIS. These alternatives were developed based on two categories of resource management goals—policy-based goals and resource-specific goals. The policy-based goals were derived from statutory and regulatory requirements. The resource-specific goals were designed to provide natural and cultural resources management guidance that is consistent with the policy-based goals and reflects the military use requirements, environmental conditions, and public access opportunities of the BMGR. The policy-based and resource-specific management goals for the BMGR are presented in Section 3.2. Based on the policy-based and resource-specific goals, 17 resource and public use categories, or resource management elements, that require management attention in the proposed INRMP were identified. These resource management elements include:

- Resource monitoring
- Special natural/interest areas
- Motorized access and unroaded area management
- Camping and visitor stay limits
- Recreation services and use supervision
- Rockhounding (surface removal only)
- Wood cutting, gathering, and firewood use, and collection of native plants
- Hunting

- Recreational shooting
- Utility/transportation corridors
- General vegetation, wildlife, wildlife habitat, and wildlife waters
- Special status species
- Soil and water resources
- Air resources
- Visual resources
- Wildfire management
- Perimeter land use, encroachment, and regional planning

Each of the five alternative management strategies addressed in this EIS includes these 17 resource management elements. The relative environmental effects of these alternative strategies are assessed in this EIS. The decision to be made involves selecting among these alternative strategies to establish a resource management program that will best support and sustain the military requirements of the range; protect, conserve, and rehabilitate natural and cultural resources; and support sustainable multipurpose public use to the extent that it is consistent with the military purposes of the range. The Secretaries of the Air Force, Navy, and Interior are responsible for determining which of the EIS alternatives are most appropriate for the BMGR. These determinations will be made in cooperation with the Director of AGFD. The decision on a program for the conservation, protection, and management of wildlife to be incorporated in the final INRMP must reflect the mutual agreement of the Secretaries of the Air Force, Navy, and Interior and the Director of the AGFD (see Table 1-2).

1.5 STUDY AREA, TIME HORIZON, AND UPDATE SCHEDULE FOR THE EIS AND PROPOSED INRMP

1.5.1 Land Area Affected by the Proposed INRMP

The proposed INRMP will be applicable to the lands within the BMGR land withdrawal established by the MLWA of 1999. This Act reduced the withdrawn area of the BMGR by approximately 35 percent by no longer including five separate tracts of land in the range (see Figure 1-1). These five tracts collectively encompass 934,179 acres (Table 1-3).

Although the MLWA of 1999 states that the new withdrawn area of the BMGR is approximately 1,650,200 acres (2,578 square miles), the full area of the range is actually 1,733,921 acres (2,709 square miles). The range includes the 1,650,200 acres of withdrawn public lands referenced in the MLWA of 1999 plus 83,721 acres of former state and private lands within the range boundary that were previously purchased by the DoD.

TABLE 1-3
LAND AREAS NOT RENEWED BY THE MLWA OF 1999

Land Area	Size	
	Acres	Square Miles
Cabeza Prieta NWR	822,000	1,284
Sand Tank Mountains Area	83,554*	131
Sentinel Plain Area	24,756	38.7
Ajo Airport Area	2,779	4.3
Interstate 8 Vicinity	1,090	1.7

*Although the MLWA of 1999 identifies the Sand Tank Mountains Area as covering 83,554 acres, the actual size of this parcel is 77,957 acres. The southwest boundary is a stair-step pattern that follows section lines rather than a straight line and the stair-step boundary reduces the size of the parcel.

1.5.2 Study Area

The area studied during preparation of this EIS differed for the various resource elements assessed. This allowed for the adequate examination of both the local and regional factors that may influence the BMGR environment as well as those that may, in turn, be affected by the proposed management actions. Potential effects on individual natural communities and special status species were assessed at scales that included their contiguous distribution both on and off of the range. The study area for earth and water resources included the Basin and Range Physiographic Province (in which the Sonoran Desert is situated) at its largest extent and selected individual geologic and soil features and principal surface water drainages within the BMGR at its most refined scale. The air resource analysis examined the airshed that contributes to the quality of air overlying the BMGR. Study areas for land use and utility/transportation corridor analyses included both the interior of the range and an area surrounding the BMGR perimeter extending to at least five miles from the range boundary. The socioeconomic study area included the communities within the perimeter area surrounding the range as well as the Phoenix and Tucson areas. Outdoor recreation management and effects were evaluated at two scales: outward from the range in terms of alternative recreation opportunities in the BMGR vicinity and within the range in terms of locations where recreation is compatible with military use. The assessment for the range road network, public health and safety, visual resources, hazardous materials and waste, and noise were all confined to the BMGR or its immediate contiguous border area. Assessments of law enforcement focused principally on issues within the BMGR but also included recognition of concerns and activities associated with the international border. Cultural resource concerns were also evaluated at several geographic scales ranging from the greater cultural region from which the contextual significance of resources within the BMGR might be surmised to the sites within the range in which such resources are located.

These same study areas were considered in the cumulative effects analysis of past, present, and reasonably foreseeable future activities with the potential to have additive or interactive impacts with the proposed INRMP.

1.5.3 Time Horizon

The time horizon, or functional period, of the proposed INRMP extends to 2024. As specified in the MLWA of 1999, the duration of the new BMGR withdrawal and reservation is 25 years from the date of the enactment of the Act. Consequently, authorization for the range will expire on 5 October 2024 unless Congress acts once again to grant authorization for continuing military use.

In order to provide for effective resource management over the course of the next 22 years, the proposed INRMP must address both long- and short-term planning horizons. To properly manage natural and cultural resources over a long period of time, planning time horizons must be as long as practicable, particularly if the goal is to effectively protect and conserve the indigenous qualities of such resources. The Secretaries of the Air Force and Navy will likely hold jurisdiction for the BMGR lands for at least the duration of the new range withdrawal.[9] Consequently, the logical long-term planning horizon for the proposed INRMP also extends to 2024. While some of the long-term goals for protecting, conserving, and rehabilitating natural or cultural resources or for maintaining sustainable multipurpose public use are presented in this INRMP without specific time-frame references, managers would like to achieve or maintain these goals over the course of the 25-year withdrawal for the BMGR.

1.5.4 INRMP Review and Amendment

The Sikes Act provides that INRMPs are to be reviewed on a regular basis, but not less than every five years [16 U.S.C. 670a (b)(2)]. This requirement reflects the fact that military activities, natural resource protection and conservation needs, and public access opportunities and patterns are likely to change over time and that there must be a mechanism for adapting an INRMP to changing conditions if the plan is to provide for effective management. The MLWA of 1999 reinforces this point by stipulating that the INRMP for the BMGR shall

> ...include procedures to ensure that the periodic reviews of the plan under the Sikes Act are conducted jointly by the Secretary of the Navy, the Secretary of the Air Force, and the Secretary of the Interior, and that affected States and Indian tribes, and the public, are provided a meaningful opportunity to comment upon any substantial revisions to the plan that may be proposed...and...provide

[9] There is a provision in the MLWA for early termination of the withdrawal and reservation if either Secretary or both determines that there is no longer a continuing military need for the range [P.L. 106-65 § 3031 (f)(1)].

procedures to amend the plan as necessary. [P.L. 106-65 §3031(b)(3)(E)(ix) and (x)].

The MLWA of 1999 further stipulates that a public report, which may be combined with any reports required by the Sikes Act, is required concurrent with each review of the INRMP. The report is to describe changes in the condition of the lands withdrawn and reserved for the BMGR. Additional requirements of the public report include: (1) a summary of current military use of the lands, (2) any changes in military use of the lands since the previous report, and (3) efforts related to the management of natural and cultural resources and environmental remediation of the lands during the previous five years [P.L. 106-65 §3031(b)(5)(A)(i) and (ii)].

This section of the EIS outlines procedures for the periodic review of the INRMP and the concurrent public report in accordance with the preceding stated requirements of the Sikes Act and MLWA of 1999. The public report will be used to:

- Provide the required five-year periodic update on the environmental conditions of the BMGR, current military use and changes in that use, and natural and cultural resources management and environmental remediation efforts

- Serve as a vehicle for conducting the five-year review and amendment, if required, of the INRMP

- Document the findings of the review and planned amendments to the INRMP

The mandated report preparation and the Sikes Act INRMP review will commence concurrently at five-year intervals following from the date of publication of the final INRMP document, which will closely follow publication of the ROD for this EIS. Updates may occur more frequently, as needed, but are mandated to occur at least every five years. Preparation of the five-year report and the INRMP review will be conducted jointly by the Secretaries of the Navy, Air Force, and Interior and the Director of AGFD [P.L. 106-65 §3031(b)(5)(A)(i) and Cooperative Agreement Section V.1.b]. The Secretaries of the Navy and Air Force will act locally through the Commanding Officers of MCAS Yuma and Luke AFB. The Secretary of the Interior will act locally through the Manager of the Cabeza Prieta NWR. It is anticipated that the BEC and IEC will be used as forums to discuss intergovernmental viewpoints as well as proposed revisions that may be appropriate for the five-year updates on the INRMP.

The five-year report will be prepared in two parts in order to facilitate the review of the INRMP and to provide ample opportunities for meaningful public comment on both the report and proposed revisions to the INRMP. The purpose of the first part of the report will be to provide information on the status of the BMGR (at the time of the report). The first part of the report will include:

- a summary of current military land use
- changes in military land use since the previous report
- changes in land and environmental conditions since the previous report
- changes in public access opportunities since the previous report
- a summary of natural and cultural resources management efforts since the most recent report
- a summary of environmental remediation activities since the most recent report
- a summary of public involvement programs since the most recent report
- proposed INRMP amendments and changes to resources management practices

The first part of the five-year report will be made available for review and comment by the public and state and local governments before the second part is prepared. Consultations with affected Indian tribes on the first part of the five-year report will also precede preparation of the second part of the report. A Notice of Availability will be placed in the Federal Register announcing the release of the report and identifying opportunities for public comment. The availability of the report may also be publicized through news releases or newsletters, agency web pages, and IEC meetings. There will be appropriate public involvement measures to support the review of the first part of the report and consultations on the report with affected Indian tribes as well as state and local governments.

The second part of the five-year report will be prepared following the close of the public comment period and completion of tribal consultations. The second part of the report, will identify proposed amendments to the INRMP and changes to natural and cultural resources management practices that would be implemented during the subsequent five-year period. The public, state and local governments, and Indian tribes will have an opportunity to comment on a draft of the second part of the report.

If warranted, proposed management decisions regarding INRMP amendments and changes to management practices will be reviewed under the auspices of the NEPA before being implemented. Otherwise, the second part of the five-year report will be revised to incorporate comments on the draft and then be made available to the public, government, and tribes before implementing the proposed amendments and management practice changes.

1.5.5 INRMP Implementation Projects and Schedule

DoD installations annually prepare schedules that identify the projects that they plan to implement during the forthcoming five-year period to carry out the management actions prescribed by their INRMPs. The year in which each project is planned for implementation and the priority of each project is identified in the schedule. Because actual implementation of each

project is dependent on the availability of funding and manpower, some lower priority projects may not be implemented. The projects included in the implementation schedule must be consistent with and provide progress towards meeting the objectives of the INRMP. Although INRMP implementation schedules are prepared for five-year budget planning cycles, they are updated each year to keep project plans up to date with ongoing progress, emerging management needs, budget constraints, and INRMP amendments.

The schedules of management projects and project priorities that will be planned by the Air Force and Marine Corps to implement the INRMP for BMGR—East and BMGR—West during the initial five-year period of the plan will be identified in the final INRMP document. These projects, which may define specific management tasks or could identify requirements for the development of additional sub-plans for managing a specific resource or activity, will be based on and consistent with the management alternative selected for the BMGR in the ROD for this EIS. Although specific projects cannot be identified until the final INRMP management alternative is selected, examples of potential forthcoming projects, that are consistent with the alternatives being examined in this EIS, include:

- posting signs within the BMGR to signify roads that are prescribed as either open or closed for vehicle use

- conducting wildlife, habitat, soil, or natural community surveys or monitoring at a prescribed level of intensity

- monitoring, constructing, repairing, maintaining, or removing artificial wildlife waters as prescribed

- monitoring public access and recreation use patterns in order to ensure that these activities remain consistent with the military mission and safety and security requirements of the range and to ensure that the level of these activities do not exceed sustainable use of range resources

The year in which each project is planned for implementation and the priority of each project will be identified in the final INRMP. Some planned projects, such as construction of new wildlife waters, may require further review under the regulations of environmental laws, such as the NEPA, ESA, or National Historic Preservation Act (NHPA) of 1966 [16 U.S.C. 470 et seq.], before being implemented. These requirements will also be identified in the final INRMP.

1.6 RELATIONSHIP OF THE INRMP TO THE INTEGRATED CULTURAL RESOURCES MANAGEMENT PLAN

The MLWA of 1999 specifies that the INRMP for the BMGR is to include provisions for the proper management and protection of cultural as well as natural resources and for sustainable use by the public of those resources to the extent consistent with the military purposes of the range [P.L. 106-65 §3031(b)(3)(E)(i)]. The MLWA of 1999 also directs that the INRMP be prepared and implemented in accordance with the Sikes Act [P.L. 106-65 §3031(b)(3)(D)]. The scope of the Sikes Act, however, is limited to the conservation and management of natural resources on DoD lands and does not include guidance for the management and protection of cultural resources. The guidance of these two Acts raises two important questions regarding cultural resources management including:

- To what extent should cultural resources management and protection provisions be addressed in the proposed INRMP?
- What constitutes sustainable public use of cultural resources?

With regard to the first question, DoD agencies typically prepare separate INRMPs and ICRMPs for the management of natural and cultural resources on military reservations. As indicated, the Sikes Act provides guidance for the management of natural resources. Authority and guidance for cultural resources management on DoD lands is derived from a number of other individual federal laws, federal regulations, executive orders and memoranda, federal guidelines, and military requirements (Table 1-4).

DoD has developed cultural resources management policies for properties under its jurisdiction based on the collective directives and guidance established by these legal instruments. These policies are incorporated in DoD Instruction 4715.3, Environmental Conservation Program, which establishes policies for the management of both natural and cultural resources on DoD lands. Among others, key DoD policies on cultural resources management, defined in DoD Instruction 4715.3, include:

- Cultural resources under the control of DoD shall be identified, protected, curated, and interpreted through a comprehensive program that complies with legally mandated requirements and results in sound and responsible cultural resources stewardship (DoD Instruction 4715.3, Section 4.3.1).

- DoD installations shall develop a program to preserve the historic character and function of military properties in a cost-effective manner that supports the military mission and protects the health and safety of the occupants and employees (DoD Instruction 4715.3, Section 4.3.2).

TABLE 1-4 FEDERAL LAWS, FEDERAL REGULATIONS, EXECUTIVE ORDERS AND MEMORANDA, FEDERAL GUIDELINES, AND MILITARY REQUIREMENTS FROM WHICH AUTHORITY AND GUIDANCE FOR THE MANAGEMENT AND PROTECTION OF CULTURAL RESOURCES ON DOD LANDS IS DERIVED
Federal Laws
Military Lands Withdrawal Act of 1999, P.L. 106-65
Antiquities Act of 1906, P.L. 59-209, 16 U.S.C. 431-433
Historic Sites Act of 1935, as amended, P.L. 74-292, 16 U.S.C. 461-467
National Historic Preservation Act of 1966, as amended, P.L. 89-665, 16 U.S.C. 470-470M
National Environmental Policy Act of 1969, P.L. 91-190, 42 U.S.C. 4321 et seq.
American Indian Religious Freedom Act of 1978, P.L. 95-341, 42 U.S.C. 1996
Archaeological Resources Protection Act of 1979, as amended, P.L. 96-95, 16 U.S.C. 470aa-470mm
Native American Graves Protection and Repatriation Act of 1990, P.L. 101-601, 25 U.S.C. 3001-3013
Federal Regulations
32 CFR Part 229, Archaeological Resources Protection Act of 1979; Final Uniform Regulations
36 CFR Part 60, National Register of Historic Places
36 CFR Part 63, Determinations of Eligibility for Inclusion in the National Register of Historic Places
36 CFR Part 65, National Historic Landmarks Program
36 CFR Part 68, Secretary of Interior's Standards for Historic Preservation Projects
36 CFR Part 78, Waiver of Federal Agency Responsibilities under Section 110 of the National Historic Preservation Act
36 CFR Part 79, Curation of Federally-Owned and Administered Archeological Collections
36 CFR Part 800, Protection of Historic Properties
43 CFR Part 3, Preservation of American Antiquities
43 CFR Part 10, Native American Graves Protection and Repatriation Act Regulations
Executive Orders/Memorandum
Executive Order 11593, 13 May 1971, Protection and Enhancement of the Cultural Environment
Executive Memorandum, 29 April, 1994, Government-to-Government Relations with Native American Tribal Governments
Executive Order 13007, 24 May 1996, Indian Sacred Sites
Executive Order 13084, 6 November, 2000, Consultation and Coordination with Indian Tribal Governments
Federal Guidelines
Archeology and Historic Preservation: Secretary of the Interior's Standards and Guidelines
The Secretary of the Interior's Standards for Rehabilitation and Guidelines for Rehabilitating Historic Buildings
Guidelines for Federal Agency Responsibilities under Section 110 of the National Historic Preservation Act
Guidelines for Restricting Information on the Location of National Register Properties
Consultation with Native Americans Concerning Properties of Traditional Religious Cultural Importance, Advisory Council on Historic Preservation, 1993
Guidelines for Evaluating and Documenting Traditional Cultural Properties, 1994
Military Requirements
DoD Directive 4710.1, Archeological and Historic Resources Management, 21 Jun 1984
DoD Instruction 4715.3, Environmental Conservation Program, 3 May 1996
DoD American Indian and Alaska Native Policy, 20 October 1998
Air Force Instruction 32-7065, Cultural Resources Management, 13 June 1994
Interim Guidance: Treatment of Cold War historic Properties for U.S. Air Force Installations
Secretary of the Navy Instruction 4000.35, Department of the Navy Cultural Resources Program, 1992
Marine Corps Environmental Compliance and Protection Manual

- ICRMPs shall be prepared, maintained, and implemented for all lands and waters under DoD control that contain cultural resources (DoD Instruction 4715.3, Section 4.3.3).

Because the authority and guidance for natural and cultural resources management programs on military installations are derived from separate sets of legislation and regulatory requirements, INRMPs and ICRMPs are often developed as separate management documents. In accordance

with DoD Instruction 4715.3, which calls for the development of separate INRMP and ICRMP management documents, each branch of the armed services has developed instructions for implementing the required natural and cultural resources management programs. Guidance for preparing ICRMPs for Air Force and Marine Corps installations are found in AFI 32-7065, Cultural Resources Management, and Marine Corps Order P5090.2A, Environmental Compliance and Protection Manual.

Work on the development of an independent ICRMP for the BMGR was under way by the time the MLWA of 1999 was enacted. In order to comply with the MLWA of 1999, which requires that the INRMP for the BMGR provide for the proper management and protection of both natural and cultural resources, the preliminary cultural resource management goals identified in the ICRMP have been adopted in this INRMP. The ICRMP goals, in no particular order of priority, include:

Goal 1. Conflicts between resource protection and mission needs are minimized.

Goal 2. Cultural resources are routinely considered by cooperating agencies as a part of project planning and design, for all activities on BMGR.

Goal 3. Cultural resources on BMGR are preserved in place to the fullest extent possible.

Goal 4. Cultural resources on BMGR are identified, and evaluated (as consistent with Air Force and Marine Corps guidance) for the National Register of Historic Places.

Goal 5. Input from Native American tribes and groups that attach cultural significance to places on BMGR will be encouraged to the fullest extent possible.

Goal 6. Native American concerns for heritage resources (both natural and cultural) are identified and addressed, and Native Americans have access to heritage resources to the maximum degree consistent with Air Force/Marine Corps mission requirements.

Goal 7. Research involving places on or materials and information collected from BMGR is of the highest professional quality.

Goal 8. Native Americans, archaeologists, and the general public benefit from and have access to information about cultural resources on BMGR to the extent consistent with Air Force and Marine Corps responsibilities for resource protection and public education and outreach.

The natural resources management goals adopted for the proposed INRMP (see Section 3.2) are compatible with these cultural resources management goals as are the management alternatives studied for implementing the natural resources management goals.

The question of what constitutes sustainable public use of cultural resources on the BMGR raises an issue that is of direct relevance to the proposed INRMP. The Sikes Act provides that INRMPs must support sustainable multipurpose public use of natural resources—including hunting, fishing, trapping, and non-consumptive uses—to the extent that such use is consistent with the use of military installations to ensure the preparedness of the Armed Forces [16 U.S.C. 670a (a)(3)]. The concept of sustainable consumptive use of natural resources (such as wildlife, timber, water, or agricultural harvests) is based on the premise that these resources are generally renewable and can be managed to provide an annual or periodic yield of goods, services, and direct and indirect benefits into perpetuity (DoD Instruction 4715.3, Subparagraph E3.1.26). Cultural resources, however, are not renewable, are in finite supply, are often readily susceptible to damage or loss, and, except in rare circumstances, cannot be recovered or restored once damaged. Because of these characteristics, the broad body of federal laws, regulations, and other forms of guidance addressing management of cultural resources on military installations and other federal lands has stressed the need to protect, curate, and interpret rather than use these resources (see Table 1-4). The concept of sustainable consumptive use has not been recognized as being compatible with cultural resource management requirements.

Non-consumptive use of cultural resources is also a problematic concept because of the vulnerability of these resources to physical damage, loss of historic information potential, or damage to or desecration of their cultural or religious values. In general, use of culture resources on federal lands has been permitted only in terms of the public benefits that can be derived from non-consumptive viewing and interpretation of these resources in place. In some cases, exceptional prehistoric or historic sites, such as Casa Grande NM or the Yuma Territorial Prison State Historic Park, are developed to provide a protective interpretive setting that encourages and sustains non-consumptive public enjoyment of these cultural resources without causing further deterioration of the site.

Park or park-like development and interpretation are not appropriate, however, for most of the cultural resource artifacts and sites found in backcountry settings such as the BMGR. Interpretive development is also a management application of limited usefulness because such developments may harm the historic context in which many cultural resources are found and, thus, diminish their overall quality or value. In addition, such developments are expensive to establish and maintain, and may be more likely to diminish rather than promote the security of artifacts or a site. Interpretive development may also be out of place with the undeveloped context of many backcountry settings.

Public use of culture resources in most public land locations, including the BMGR, is limited to non-consumptive viewing of artifacts or sites that may be encountered and recognized. The public is informed, however, that culture resources are protected by law from collection or intentional damage and are not to be disturbed in any way that disrupts the condition or setting in which the resources are found. These limits generally represent the extent to which public use of cultural resources may be sustained on the BMGR. There are instances where interpretation of historic military, ranching, and mining sites may be compatible with public use of the BMGR. In the majority of cases, cultural resources within the range may be sensitive or vulnerable to such a degree that they cannot be sustained without special protections from typical public use. Access to the affected cultural resource location may have to be limited or restricted in these circumstances.

1.7 RESPONSIBILITIES OF THE SECRETARIES OF THE NAVY AND AIR FORCE RELATIVE TO INDIAN TRIBES

The MLWA of 1999 requires that the INRMP for the BMGR:

> be developed in consultation with affected Indian tribes and include provisions that address how the Secretary of the Navy and the Secretary of the Air Force intend to—
>
> (I) meet the trust responsibilities of the United States with respect to Indian tribes, lands, and rights reserved by treaty or Federal law affected by the withdrawal and reservation;
>
> (II) allow access to and ceremonial use of sacred sites to the extent consistent with the military purposes for which such lands are withdrawn and reserved; and
>
> (III) provide for timely consultation with affected Indian tribes [P.L. 106-65 §3031(b)(3)(E)(ii)].

The steps that are being taken for consulting with Indian tribes on the development of the INRMP are described in Section 1.8. This section provides an overview of how the Secretaries of the Navy and Air Force intend to meet the trust responsibilities of the United States relative to Indian tribes, lands, and treaty rights; allow tribal access to the BMGR; and provide for timely consultations with affected tribes. These issues are addressed in detail in the ICRMP that was separately prepared and reviewed and that will be incorporated by reference in the proposed INRMP, as described in Section 1.6.

The DoD has developed an American Indian and Alaskan Native Policy that establishes principles for DoD components to follow when interacting and working with federally-recognized American Indian and Alaskan Native governments (DoD American Indian and Alaska Native Policy, 1998). The preamble to the policy states:

> These principles are based on tribal input, federal policy, treaties, and other federal statutes. The DoD policy supports tribal self-governance and government-to-government relations between the federal government and tribes. Although these principles are intended to provide general guidance to DoD components on issues affecting tribes, DoD personnel must consider the unique qualities of individual tribes when applying these principles, particularly at the installation level. These principles recognize the importance of increasing understanding and addressing tribal concerns, past, present, and future. These concerns should be addressed prior to reaching decisions on matters that may have the potential to significantly affect protected tribal resources, tribal rights, or Indian lands.

Among other principles, the policy declares that DoD will meet its trust responsibilities to tribes and that DoD will annually review the status of its relationship with tribes to ensure that DoD is fulfilling its federal responsibilities and addressing tribal concerns related to protected tribal resources, tribal rights, or Indian lands. To the extent consistent with the military purposes for which the BMGR lands were withdrawn and reserved, the Secretaries of the Navy and Air Force intend to fully implement the aforementioned DoD policy by protecting tribal resources; supporting tribal access to and ceremonial use of these resources; and maintaining and, as appropriate, expanding existing consultation programs with affected tribes.

The Air Force and Marine Corps recognize that many plants, animals, topographic features, water sources, and other aspects of the natural environment of the BMGR may be of cultural value to native people of the region. Proper management and protection of culturally important plant and animal species are a part of the ongoing natural resources program for the BMGR and would be continued through the proposed INRMP. Specific projects or sub-plans that may be needed for the management and protection of these species and other culturally important natural resource features or places during the first five years of implementation of the proposed INRMP have not been defined at this time, but such projects and sub-plans will be identified as appropriate in the final INRMP (see Section 1.5.5). Consultations with tribes regarding the draft ICRMP and the draft and final EISs for the proposed INRMP will offer tribes opportunities—in addition to opportunities afforded through other consultation programs—to identify species, other natural resource features, or places within the BMGR that are culturally significant. The Air Force and Marine Corps intend to continue consultation efforts to continue to identify and address tribal concerns for culturally significant resources through the life of the INRMP. Places of cultural importance, for example traditional gathering areas, would also be treated in the ICRMP as potential historic properties. The Air Force and Marine Corps will protect information about such resources in accordance with the appropriate regulations and statutory authority.

The Air Force and Marine Corps are committed to allowing affected Indian tribes to access sacred places and traditional use areas on BMGR to the fullest extent compatible with the military mission. Requests for access within BMGR—East should be directed to the Luke AFB,

56 RMO Native American Liaison. Requests for access within BMGR—West should be directed to MCAS Yuma, Director, Range Management Department. Visits to certain military use areas within the range may be restricted to times when no hazardous training or training support activities are scheduled. Air Force or Marine Corps staff may be required to escort tribal members within these areas because of safety or security issues associated with military activities conducted within the BMGR. Specific access procedures would be developed in consultation with interested tribes.

The Air Force and Marine Corps are also committed to continuing existing consultation programs with affected Indian tribes and expanding these programs as appropriate to address emerging issues of concern to tribes. Consultations are and will continue to be initiated as early as possible in Air Force and Marine Corps planning processes. Specific guidance for these consultation programs is included in the ICRMP. Several tribal representatives have recommended shifting the emphasis of existing consultation programs from specific projects to long-range plans and programs as one means of soliciting more meaningful tribal input. A recent example of such an approach is initial consultations by the Air Force with tribes about potential improvements to BMGR—East, identified in the BMGR Mission Support Plan, to support military aircrew training. That plan identifies several weapons range upgrades and other improvements that might be needed to support anticipated pilot training objectives over the next five to seven years. Most of the recommended improvements were (and still are) at the early proposal stage when consultation was initiated and could be described in only the most general terms; project-specific consultation would be required as individual proposals are refined and other required planning steps are undertaken preceding any decisions to implement proposed improvements.

As described in Section 1.3, the IEC was established in accordance with the MLWA of 1999 to provide a forum solely for the purpose of exchanging views, information, and advice relating to the management of the natural and cultural resources within the BMGR. Membership in the IEC is limited to those agencies (federal, state, and local) and Native American tribes that may have a direct responsibility for, potential impact upon, or direct interest in the lands or resources of the range. Sixteen tribes have been invited to join the IEC and, as of August 2002, four have accepted the offer of membership.

In addition to the IEC, consultation with Indian tribes is facilitated on a frequent basis by the participation of Air Force and Marine Corps range management staff in local and regional meetings held or attended by tribal representatives in order to share information about the BMGR. For example, Air Force cultural resource staff often attends meetings of the Inter-Tribal Council of Arizona's Cultural Resource Working Group to update members on the status of surveys, proposed field trips, and other issues. Such informal avenues are an important means of information sharing; as such, they support but do not substitute for formal consultation.

1.8 PUBLIC INVOLVEMENT, NATIVE AMERICAN CONSULTATIONS, AND ENVIRONMENTAL ISSUES FOR THIS EIS

1.8.1 Public Scoping Notification and Issues Identified

A Notice of Intent (NOI) to prepare this EIS to evaluate the effects of implementing an INRMP for the BMGR was published in the *Federal Register* on 21 July 2000 (Volume 65, Number 141, page 45361) and is included in Appendix A. The NOI provided names, addresses, and telephone numbers for points of contact at Luke AFB, MCAS Yuma, BLM, and AGFD; a brief statement regarding what the draft EIS would address; and the dates, times, and locations of public scoping meetings.

In addition to the NOI, several methods were used to invite comments from potentially affected federal, state, and local agencies, Native American Tribes, and interested non-governmental organizations and persons during the public scoping period. These methods included news releases to newspapers, radio and television stations, and magazines; newspaper display advertisements announcing the public scoping meetings; and a newsletter to about 330 individuals who expressed interest in the INRMP planning process. Public scoping meetings were held in the Arizona communities of Phoenix, Tucson, Yuma, Gila Bend, Ajo, and Sells. Additional newsletters have been periodically mailed to nearly 500 persons as the INRMP planning process has continued.

During the formal 30-day public scoping period, a total of 65 persons provided comments. About half of the comments were received from persons who attended the public scoping meetings. Some persons submitted comments more than once, which resulted in a total of 74 written and oral responses received during the scoping period. While most of the comments were brief, many of them addressed multiple issues. From the 74 written and oral responses, a total of 381 individual issue-specific comments were identified. Issue-specific comments were catalogued into categories, then further divided into subcategories (Table 1-5). The subcategories of wildlife management, recreation/permits, roads, roadless areas, plan management, off-highway vehicles, archaeology, Sonoran pronghorn/threatened and endangered species, and funding accounted for two-thirds of all the issue-specific comments.

TABLE 1-5
SUMMARY OF COMMENTS RECEIVED DURING PUBLIC SCOPING OR THE PUBLIC WORKSHOPS

Comment Category	Sub-Category	Summary of Comments
Atmospheric Resources	Air Resources Visual Resources	▪ Control excessive fugitive dust on heavily traveled roads. ▪ Protect mountain vistas from visual intrusions. ▪ Protect the visual quality of lands adjacent to El Camino del Diablo.
Earth and Water Resources	Mining	▪ Allow continued recreation access to inactive mine sites. ▪ Close inactive mines because they are too dangerous. ▪ Prohibit human disturbance of mines that provide habitat for bats.
	Rockhounding	▪ Prohibit rockhounding. ▪ Allow recreational rockhounding in areas that have collectable minerals.
	Soils	▪ Evaluate soils to determine if BMGR activities are contributing to subsidence.
	Water Resources	▪ Complete a watershed study of BMGR to determine the impacts to groundwater.
Perimeter Land Use, Encroachment, and Regional Planning	Development	▪ Evaluate how development in the area along Interstate 8 might infringe upon the mission of the military.
	Environmental Justice	▪ Include an environmental justice component that addresses effects on the residents from the farming communities adjacent to the BMGR.
	Flight Patterns	▪ Keep the aircraft from flying (and refueling) over Ajo.
	Immigration/Border Patrol	▪ Address the environmental effects associated with illegal immigrants.
	Noise	▪ Evaluate the impacts of noise from BMGR activities on wildlife and the humans in nearby communities.
	Non-withdrawn Lands	▪ Do not make the land surrounding the Ajo Airport a part of the Indian Reservation.
	Tribal Issues	▪ Keep any cultural sites identified by agencies and tribal members confidential.
Motorized Public Access and Unroaded Area Management	Off-Road Vehicles	▪ Prohibit off-road vehicle travel and ban off-highway vehicles and all-terrain vehicles. ▪ Limit off-road motorized vehicle access to major washes because this will minimize the destruction of most other natural resources. ▪ Allow off-road motorized public access only in major washes (nowhere else) because this will minimize the destruction of most other natural resources. ▪ Take archaeological sites into consideration when allowing motorized public access.

TABLE 1-5
SUMMARY OF COMMENTS RECEIVED DURING PUBLIC SCOPING OR THE PUBLIC WORKSHOPS

Comment Category	Sub-Category	Summary of Comments
	Roads	▪ Preserve public access to existing roads. ▪ Designate a road system that is the minimum necessary to achieve military purposes. ▪ Close redundant, unnecessary, or damaging travel routes. ▪ Do not reduce the road network to one or two roads because it will cause destruction of resources.
	Roadless Areas	▪ Protect roadless and wilderness characteristics to protect the ecological health and biological diversity of the Sonoran Desert.
Recreation Services and Use Supervision	Hunting	▪ Do not allow hunting of any kind. ▪ Preserve existing hunting access and rights. ▪ Address hunting of non-game species. Restrict or prohibit collection of lizards and snakes, especially rosy boas, to help prevent the degradation of wildlife habitat.
	Law Enforcement	▪ Provide the funds necessary to train enforcement officers and to enforce management standards. ▪ Post signs to keep people out of safety hazard areas if off-road vehicle use is allowed.
	Public Access	▪ Continue to allow public access on El Camino del Diablo and provide historical interpretive sites. ▪ Do not limit existing public access anywhere on the range.
	Public Education	▪ Develop interpretive sites at Tinajas Altas for public education. ▪ Partner with Yuma County and other public agencies on funding for projects. ▪ Offer public education activities or presentations regarding natural resources on the range to schools in the area.
	Firewood	▪ Prohibit wood collecting because there is so little wood on the range. Snags are naturally beautiful. Require recreationists to bring their own wood for campsites. ▪ Allow some woodcutting, particularly for campfires in the backcountry.
	Recreation/Permits	▪ Maintain a permit system for recreational access.
	Camping	▪ Consider allowing vehicle-based camping within 100 feet of existing roads designated as open to public access. ▪ Consider allowing camping in one location for 31 days to coincide with the duration of the bighorn sheep hunting season. ▪ Limit camping in one location to 14 days. ▪ Do not designate camping areas as this would concentrate too much activity in one area and destroy natural resources. ▪ Designate certain roads as acceptable for off-road camping and prohibit off-road camping along other roads. ▪ Prohibit the dumping of human waste from campsites on the range.
	Recreational Shooting	▪ Provide opportunities for recreational shooting on the range.
General Vegetation, Wildlife, Wildlife Habitat, and Wildlife Waters	Conservation Biology	▪ Incorporate and adopt conservation management concepts.
	Fire Management	▪ Do not over-manage by suppressing all fires. ▪ Evaluate the threat of invasive plants for elevating the risk of catastrophic wild fires.
	Livestock	▪ Remove/prevent trespass livestock.

TABLE 1-5
SUMMARY OF COMMENTS RECEIVED DURING PUBLIC SCOPING OR THE PUBLIC WORKSHOPS

Comment Category	Sub-Category	Summary of Comments
	Predator Control	▪ Institute predator control measures only where essential to conserve or recover endangered or declining species.
	Sonoran Pronghorn and Threatened and Endangered Species	▪ Consider designating seasonal refuges for Sonoran Pronghorn by limiting recreational and military activities in such areas.
	Vegetation	▪ Control invasive, non-native plant species, particularly buffel grass and Sahara mustard.
	Wildlife Management	▪ Implement wildlife management activities (including the construction of artificial water developments) only where supported by the best available science. ▪ Ensure water for bighorn sheep survival. ▪ Develop new water catchments in the future. ▪ Conduct studies to verify whether artificial water developments are beneficial to wildlife. ▪ Evaluate the potential for spreading non-native species before allowing the establishment of artificial water developments because non-native species compete with native species for survival. ▪ Allow for natural population fluctuations, as this may be appropriate for the health of the ecosystem.
Miscellaneous	Cultural Resources	▪ Fully consider cultural resource protection and management requirements in the development of alternatives for all other resources. ▪ Protect archaeological resources and inventory known sites.
	Data	▪ Use the best available scientific data and modern management principles relating to landscape ecology and conservation biology.
	Designated Areas	▪ Continue to protect areas currently designated as areas of critical environmental concern (ACECs).
	Ordnance	▪ Identify the impacts of ordnance on natural and cultural resources.
	Plan Management	▪ Develop alternatives that are consistent with the goals and management prescriptions of other federal land management in the region. ▪ Identify any discrepancies, incompatibilities, and/or potential conflicts with existing land management plans for this area
	Targets	▪ Reevaluate the need for various targets and remove those that are no longer needed.

1.8.2 Public Workshops

Two public workshops were conducted after the formal scoping period had closed to obtain further public input into the continuing development of the goals and alternatives for the INRMP. The first workshop was held on 18 November 2000 and the second on 20 January 2001. Both of these one-day workshops were held at the Gila Bend Air Force Auxiliary Field (AFAF) in Gila Bend, Arizona. These workshops provided considerable opportunities for discussion about resource management issues between the public attendees and the agencies responsible for natural and cultural resources on the BMGR.

The November 2000 workshop was attended by 23 members of the public together with 14 persons affiliated with the INRMP Core Planning Team agencies and their consultants. One purpose of this workshop was to review with the attendees changes that have been made to the policy-based and resource-specific management goals as a result of input during public scoping and to receive their comments on this issue. The Core Planning Team finalized the goals following the November workshop.

The primary purpose of the November workshop was to present draft alternative strategies for the management of the BMGR to the attendees and to obtain their comments on whether or not the range of alternatives presented included their personal viewpoints on how the range should be managed. The consensus from the workshop was that each individual found that his or her opinion about range management was represented by the strategies offered, although some people liked some components of one strategy for some resource management elements and components of a different strategy for other management elements. The public attendees were also asked to identify resource management elements that they felt were not included in the draft alternative strategies. As a result of this input, a resource management element regarding perimeter land use, encroachment, and regional planning was added to the list for which alternative management strategies were needed. The Core Planning Team revised the draft alternative management strategies based on the public input received at the November workshop.

The January 2001workshop was attended by 39 persons from the public and 19 persons affiliated with one of the Core Planning Team agencies or their consultants. This workshop had two purposes. First, the alternative management strategies that had been revised based on input from the first public workshop were presented. Alternative strategies for managing wildlife water developments had not been discussed during the November workshop, so this issue was presented and discussed with the attendees for the first time. The Core Planning Team completed final revisions to the alternative management strategies based on the public input following this workshop.

The second purpose of the January workshop was to conduct an interactive exercise with the public attendees concerning their interests in public road access within the BMGR and the implications of roads within the range for resource protection and conservation. The increasing extent and density of the road network within the BMGR had become a major resource management issue identified by the public both in scoping for the proposed INRMP and in previous BMGR management documents. The workshop was designed around maps, prepared by the Core Planning Team, that presented four draft alternative strategies for managing the road network within the range. All four strategies were based on the existing range road network but varied in terms of the extent of the network that would be retained under the final INRMP for public and agency use. At one end of the spectrum was a strategy representing the minimum road network that the Core Planning Team identified as necessary to support the ongoing military, resource management, and law enforcement missions on the range. This strategy would provide the least amount of public road access within the BMGR. The perceived trade-off of a reduced road network was a potential increase in resource protection. At the other end of the spectrum was a strategy that would retain the entire existing road network. This network would exceed current agency access but would provide the greatest degree of vehicle travel opportunities to the public. This strategy would presumably preclude some opportunities for increased resource protection by minimizing the restrictions on vehicle access to the interior of the range. The public attendees at the workshop were asked to review the four alternative strategies, provide recommendations on how the strategies might be revised to provide better balance between public access needs and resource protection requirements, and voice their support for or opposition to one or more of the strategies. The consensus among the attendees was that the four road network strategies generally represented the range of concerns about public access and resource protection. The Core Planning Team made final adjustments to the four road network strategies after reviewing both public input from the January workshop and their own agency needs for vehicular access. A summary of the public comments provided at both workshops is incorporated in Table 1-5.

1.8.3 Newsletters and Internet Information

During the course of the project, newsletters were mailed to individuals and organizations expressing interest in the INRMP and EIS process. The initial newsletter was mailed to about 330 persons and the mailing list has grown as persons who attended project meetings or expressed interest in some other way were added.

The first newsletter, published in July 2000, introduced the plan to develop an INRMP and invited the public to attend one of the six public scoping meetings to provide their input to the planning process.

In early November, the second newsletter was published and provided the results of the public scoping process, explained which agencies were involved in the planning process, described some of the Marine Corps training and the recreational opportunities within BMGR—West, and invited the public to participate in a workshop to help define project alternatives.

The third newsletter was issued in January 2001. It reported the issues discussed during the November workshop and invited the public to participate in a second workshop that would primarily focus on the road network for each alternative management strategy as well as the future approach to wildlife water developments. In addition, the third newsletter introduced that The Nature Conservancy (TNC) would be providing technical support in the planning process and contributing to the protection of biodiversity within a regional context. A few of the recent and ongoing biological studies were also highlighted.

In March 2002, a fourth newsletter announced that the release of the draft EIS for the development of the INRMP had been delayed because of a lawsuit regarding the Sonoran pronghorn. It was explained that the lawsuit resulted in the need to re-evaluate certain elements of several Biological Opinions and NEPA documents, including some that directly affected the BMGR. As a result of the new Biological Opinions, the agencies proposing activities or having management responsibilities for lands within Sonoran pronghorn habitat agreed to limit recreational access within the BMGR region from 15 March through 15 July. The newsletter included a map showing these seasonal access limitations and also explained why a permit would still be required to access the portion of the Sonoran Desert NM that had once been part of the BMGR.

In addition, information regarding the BMGR and the INRMP planning process is maintained and updated on various Internet web sites. The Luke AFB web site provides the most comprehensive information about the BMGR (available at www.luke.af.mil by clicking on Barry M. Goldwater Range). Information available at this site includes an overview of the BMGR physical setting, range renewal, archaeological resources, public outreach, range operations, natural resources, and range history. Copies of certain documents are also available at this Internet site and include the community report summarizing the LEIS for the renewal of the BMGR land withdrawal, the MLWA of 1999, a primer on the purpose of and process of developing an INRMP, the alternative strategies for future BMGR management as presented at the 20 January 2001 public workshop, and other related EAs. Information about public meetings regarding BMGR management is also announced on the Luke AFB BMGR web page.

Some summaries regarding BMGR-related meetings are available on the BLM's Phoenix Field Office web site along with the BLM's report to Congress for the BMGR non-renewed parcels study. The web site for MCAS Yuma also provides information about the BMGR including how to obtain a range access permit and the rules for BMGR visitors.

1.8.4 Native American Consultation

Potentially interested Native American tribes and groups throughout Arizona, as well as tribes in California and New Mexico with a stated interest in the BMGR, were provided with information about the proposed INRMP development process and invited to participate. INRMP newsletters were sent to tribal representatives. Before the first scoping meeting, 56 RMO sent letters to tribal leaders informing them that the Air Force and Marine Corps were beginning the process of soliciting input and developing an INRMP and inviting them to participate in the preparation of the INRMP. One of the scoping meetings was held in Sells, Arizona on the Tohono O'odham Nation. Later, tribal leaders were invited to attend or send representatives to workshops and also were asked to identify other avenues, such as briefings to tribal councils or other bodies or field visits to places of interest or concern on BMGR, that would facilitate their participation in the process.

Because the Air Force and Marine Corps recognize that many plants, animals, topographic features, water sources, and other aspects of the natural environment have cultural value for the native people of the region, a series of questions were posed in a effort to identify issues of concern, including particular resources, resource management, and access to places of importance on the BMGR. These questions and issues included:

- Identify plant or animal species, natural features, areas, or environmental zones that are of particular concern to your community or tribe.

- Do you have specific concerns about past natural resource management activities, including public use of or impacts to natural resources on BMGR?

- Please describe any resource management or land-use/access practices you wish to recommend. These may apply to the entire BMGR or may be resource-specific.

- Identify areas of BMGR to which your tribe or community needs access for traditional practices (such as traditional plant gathering areas). How should arrangements for access be made?

- How would you/your community like to participate in natural resource management programs on BMGR in the future? Some examples are: participating in monitoring programs, reviewing proposals for natural resource projects, and participating in project-related field work.

A summary of comments received as a result of Native American consultation are:

- Continue efforts to preserve and protect cultural resources and, in particular, continue to involve tribes in the cultural resource aspects of the plan

- Prohibit off-road vehicular travel, particularly because such activity damages resources

- Ensure DoD maintains adequate cultural and biological staffing to address the complexity of the BMGR and the associated management issues

- Control recreational access to protect natural and cultural resources

- Coordinate with and involve tribes in range management activities

- Concern for tinajas and other natural water sources on the range and their development as wildlife waters

1.9 RESOURCE CATEGORIES TO BE CONSIDERED

Resource categories analyzed in this EIS were determined through a consideration of the resources on the BMGR that would be affected by the proposed INRMP, the results of public scoping and public workshops, and regulatory requirements. The environmental and natural resources management elements analyzed include earth resources, water resources, climate and air resources, vegetation, wildlife and wildlife habitats, protected species, wildfire management, grounds maintenance, public utility/transportation corridors, special management areas, outdoor recreation, public health and safety, law enforcement, perimeter land use, cultural resources, visual resources, hazardous materials and waste, socioeconomics, noise, and environmental justice.

1.10 REQUIRED LICENSES, PERMITS, OR ENTITLEMENTS

This EIS was prepared in accordance with the NEPA (42 U.S.C. 4321-4347, as amended), CEQ regulations for implementing the procedural provisions of the NEPA (40 CFR Parts 1500-1508), the Air Force Environmental Impact Analysis Process (32 CFR Part 989, as amended), and Marine Corps Order 5090.2A. In addition to meeting these requirements generated by the NEPA, it may be necessary for the Air Force and Marine Corps to meet additional federal compliance requirements in order to implement the plan. Those identified include the following:

- In accordance with Section 7(a)(2) of the Endangered Species Act, the Air Force and Marine Corps must consult with the Secretary of the Interior (USFWS) to ensure that implementation of the INRMP is not likely to jeopardize the continued existence of any

federally threatened or endangered species or result in the destruction or adverse modification of any habitat determined to be critical to threatened or endangered species.

- Section 106 of the NHPA requires all federal agencies to take into account the effects of their actions on properties listed or eligible for inclusion on the National Register of Historic Places and to provide the Advisory Council on Historic Preservation (ACHP) an opportunity to comment on those actions and their potential effects. Implementing the proposed INRMP is an action subject to Section 106 review. In accordance with the ACHP's implementing regulation (36 CFR Part 800), the Air Force and Marine Corps are required to consult with the Arizona State Historic Preservation Officer, concerned Native American tribes, and others, about this plan and its potential effects on eligible properties.

The proposed INRMP is intended to be largely programmatic in nature. That is, it is generally of broad-scope, as is appropriate for a plan and program for natural and cultural resources management on the BMGR extending through the range renewal period (to 2024). While some site-specific actions may be identified, most of the proposed INRMP actions are goal-oriented protocols for resource management. This programmatic makeup supports the adaptive management approach on which the proposed INRMP is based. In this EIS, the potential environmental impacts of these proposed INRMP actions are identified and assessed in context of the individual and cumulative impacts of ongoing and reasonably foreseeable future actions at the BMGR. Further site-specific environmental analysis may be needed prior to the implementation of some of the actions covered under the selected management program as identified in Section 1.5.5.

CHAPTER 2
BMGR MILITARY MISSION AND RESOURCE MANAGEMENT SETTING

2.1 INTRODUCTION

As established in Section 1.1, the proposed INRMP for the BMGR must support the military purposes of the range while providing for the proper management and protection of its natural and cultural resources and sustainable public use consistent with those military purposes. This chapter describes the military use and resource management setting in which the proposed INRMP must accomplish these tasks.

The chapter begins with a description of the current military mission and land use requirements at the BMGR that must be supported by the INRMP (Section 2.2). Section 2.3 describes the history of the BMGR including its acquisition, historical military use, and natural and cultural resource management history. This historical information provides context for understanding the co-evolution of military and management activities within the BMGR and the relative importance of current management issues. Section 2.4 reviews DoD land management policy guidance that governs how military reservation lands are to be managed to support the needs of ongoing and future military missions.

Land use and resource management within the BMGR is also affected by the missions and activities of certain non-military agencies. As indicated in Section 1.3, AGFD plays a major role in the management of wildlife resources both within the BMGR and on lands within Arizona that neighbor the range. The proximity of the range to the international border between the United States and Mexico has given the U.S. Border Patrol an active law enforcement mission that, in part, takes place within the range. The activities of AGFD and the U.S. Border Patrol are described in Section 2.5.

The safety and security requirements of the military mission as it relates to public access opportunities within the BMGR are described in Section 2.6. This section also defines resource management units within the range that are based on these safety and security requirements, public access opportunities, and natural and cultural resource conditions. The alternative resource management strategies that are studied in this EIS for the development of the proposed INRMP are focused, in part, on these management units.

Section 2.7 describes natural and cultural resource management opportunities and constraints within the BMGR that are derived from the military mission of the range, existing natural and cultural conditions, and public access and use opportunities and constraints. The management opportunities and constraints described in this section are drawn from the conditions described in the preceding sections of Chapter 2. The resource management goals and alternative management strategies presented in Chapter 3 reflect these opportunities and constraints.

Finally, Section 2.8 closes Chapter 2 with descriptions of (1) DoD requirements to apply ecosystem management principles to the management, conservation, and protection of resources within the BMGR, and (2) the need to address the pre-existing management issues within the proposed INRMP. This section also addresses the importance of both resource monitoring and adaptive management as ecosystem management tools.

2.2 CURRENT MILITARY MISSION AND LAND USE OF THE BMGR

As previously noted, BMGR lands are made available for military purposes by virtue of the MLWA of 1999 for use as (1) an armament and high-hazard testing area; (2) training for aerial gunnery, rocketry, electronic warfare, and tactical maneuvering and air support; and (3) other defense related purposes. The current primary mission of both BMGR—East and BMGR—West is military aircrew training. The range has been used periodically for testing and some other defense related purposes, but, since its inception, non-training activities have been secondary to the primary training mission of the BMGR (see Section 2.3.2 for a review of past military use of the BMGR). The primacy of the aircrew training mission at the BMGR is expected to continue into the foreseeable future.

The current primary mission of BMGR—East is to support the training of Air Force, Air Force Reserve Command (AFRC), Air National Guard (ANG), and Army Reserve National Guard (ARNG) student aircrews transitioning to frontline combat aircraft. Regular users currently served in this capacity by BMGR—East include the:

- Air Education and Training Command (AETC), 56th FW, Luke AFB, which trains Air Force F-16 aircrews
- Air Combat Command (ACC), 355th Wing, Davis-Monthan AFB, which trains all Air Force A-10 and OA-10 aircrews
- AFRC, 944th FW, Luke AFB, which trains AFRC F-16 aircrews
- ANG, 162nd FW, Tucson International Airport, which trains F-16 aircrews for the ANG and U.S. foreign allies that are recipients of Foreign Military Sales F-16s[10]
- ARNG, Western ARNG Aviation Training Site (WAATS), Silverbell Army Heliport, which trains UH-60, AH-1, and AH-64 aircrews

BMGR—East is also used to support readiness training by aircrews from operational (i.e., combat ready) units. Regular BMGR—East users currently served in this capacity include the:

- ACC, 355th Wing, Davis-Monthan AFB, A-10 and OA-10 aircrews

[10] F-16 aircraft that are sold to U.S. foreign allies.

- ANG, 162nd FW, Davis-Monthan AFB, hosts seasonal ANG and AFRC training deployments to the BMGR (this ANG activity is officially referred to as Operation Snowbird)
- ARNG, 1/258th Attack Helicopter Battalion (AHB), Silverbell Army Heliport, UH-60 and AH-64 aircrews

The current primary mission of BMGR—West is to support readiness training by Marine Corps and Navy aircrews from operational units. Regular users currently served in this capacity by BMGR—West include the:

- Marine Aircraft Group (MAG) 13, MCAS Yuma, AV-8B and F-5 aircrews
- Marine Aviation Weapons and Tactics Squadron (MAWTS) 1, MCAS Yuma, aircrews from all types of Marine aviation units
- 3rd Marine Aircraft Wing (MAW), MCAS Miramar, F/A-18, C-130, AH-1, CH-46, and CH-53 aircrews
- MCAS Yuma, host to training deployments from Marine Corps and Navy aviation units from throughout the fleet

In addition to these regular users from the BMGR region, the range is also used to support training by "casual users" from outside the local flying area. These important casual user training deployments originate from active duty, reserve, and ANG flying units from other areas of the country and from U.S. and allied units from overseas. MCAS Yuma is the most active deployment site for Marine aviation units from both the east and west coasts. The air station hosts between 50 and 70 unit deployments involving up to 700 aircraft per year. The air station hosts Navy fliers as well. On the Air Force side, Davis-Monthan AFB is the host installation for a long-standing "Operation Snowbird" training program involving 15 to 20 Air Force Reserve and ANG units and up to 200 aircraft per year. Operation Snowbird is a hosted Air Force program established to allow units that are stationed in locations with seasonably severe (usually winter) weather to deploy for one or more weeks for fair weather training on the BMGR. A permanent tenant organization is in place at Davis-Monthan AFB to administer the Snowbird program. No other ranges located in warm climates have both the needed air base and range capabilities and range time capacity to accommodate the Snowbird program. Without the BMGR and its favorable weather, Snowbird units would experience decreased combat readiness through the winter months.

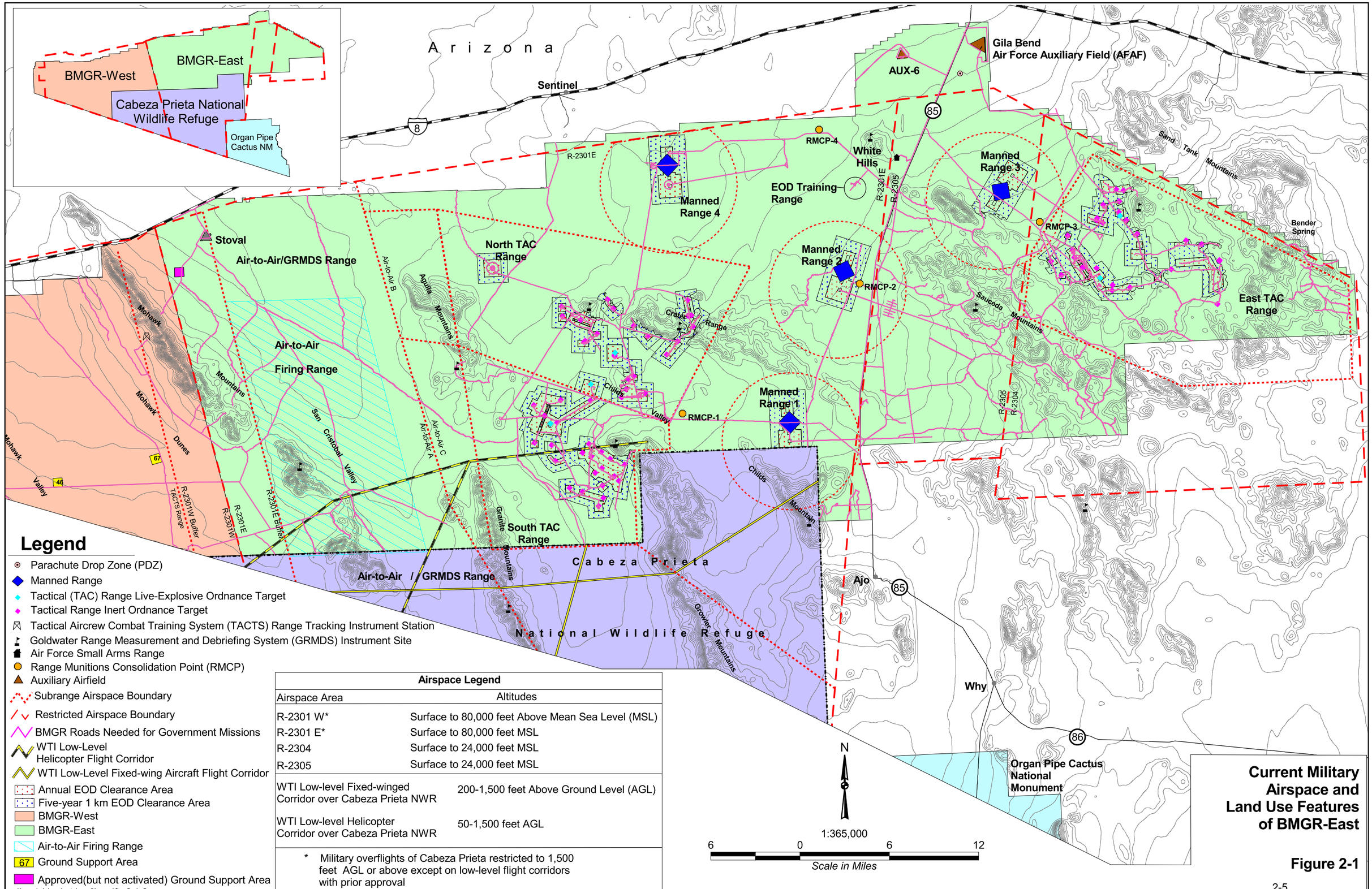
From the perspective of supporting military operations, the BMGR is composed of lands reserved for military purposes and overlying restricted airspace (Figures 2-1 and 2-2). The four restricted airspace areas overlying the range—R-2301E, R-2301W, R-2304, and R-2305—are designated by the Federal Aviation Administration (FAA) to support the military training missions of the range. BMGR—East and BMGR—West currently support a wide diversity of tactical aviation training activities as well as selected ground training and training support

operations. To support these activities and operations, BMGR—East and BMGR—West land areas and restricted airspace are partitioned into a number of smaller subranges or operations areas in order to provide locations where multiple simultaneous training or other operations can be effectively and safely supported. The use and operation of BMGR—East is controlled by AFI 13-212 Volume 1, Weapons Ranges, Luke AFB Supplement 1.[11] In accordance with this AFI, the BMGR—East land area is currently subdivided so as to support nine aviation subranges, one Air Force auxiliary airfield, two outlying auxiliary airfields, one Explosive Ordnance Disposal (EOD) training range, one small arms range, and four weapons range support areas (see Figure 2-1). The nine BMGR—East subranges include eight aircraft weapons ranges and an electronically instrumented air combat tactics (ACT) range. The eight aircraft weapons ranges include an air-to-air firing range for training in air-to-air gunnery or missile firing and seven subranges for air-to-ground weapons delivery training. Manned Ranges 1, 2, 3, and 4 and North, South, and East Tactical (TAC) ranges constitute the air-to-ground weapons ranges. The instrumented ACT range is the Goldwater Range Measurement and Debriefing System (GRMDS). Gila Bend Air Force Auxiliary Field (AFAF) is the Air Force auxiliary airfield and the two outlying auxiliary airfields include Auxiliary Airfield 6 (AUX-6) and Stoval Auxiliary Airfield.

The use and operation of BMGR—West is controlled by MCAS Yuma Station Order 3710.6H. The BMGR—West land area is currently partitioned into four aviation subranges, 35 existing and four approved undeveloped ground support areas, an outlying auxiliary airfield, a developed training complex, a rifle range, a parachute cargo drop zone, an EOD operating area, and a live ordnance jettison area range (see Figure 2-2). The four aviation subranges include: the Auxiliary Airfield 2 (AUX-2) operating area, the Moving Sands and Cactus West target complexes, and the tactical aircrew combat training system (TACTS) range. The 39 total undeveloped ground support areas are locations to which Marine ground units may deploy for various periods of time to participate in training exercises that involve both Marine air and ground units. The outlying auxiliary airfield is AUX-2 and the developed training complex is the Cannon Air Defense Complex. AUX-2 also serves as an additional ground support area for ground unit deployments.

Current subranges and other land use areas of the BMGR are described in the following sections beginning with BMGR—East (Sections 2.2.1 through 2.2.7) and followed by BMGR—West (Sections 2.2.8 through 2.2.9).

[11] AFI 13-212 Volume 1 Luke AFB Supplement 1 provides official information and procedures for all units/users, military or civilian, operating in BMGR—East. Among other components, this AFI includes procedures governing all surface access to BMGR—East. Compliance with all provisions of this AFI is mandatory for all range users.



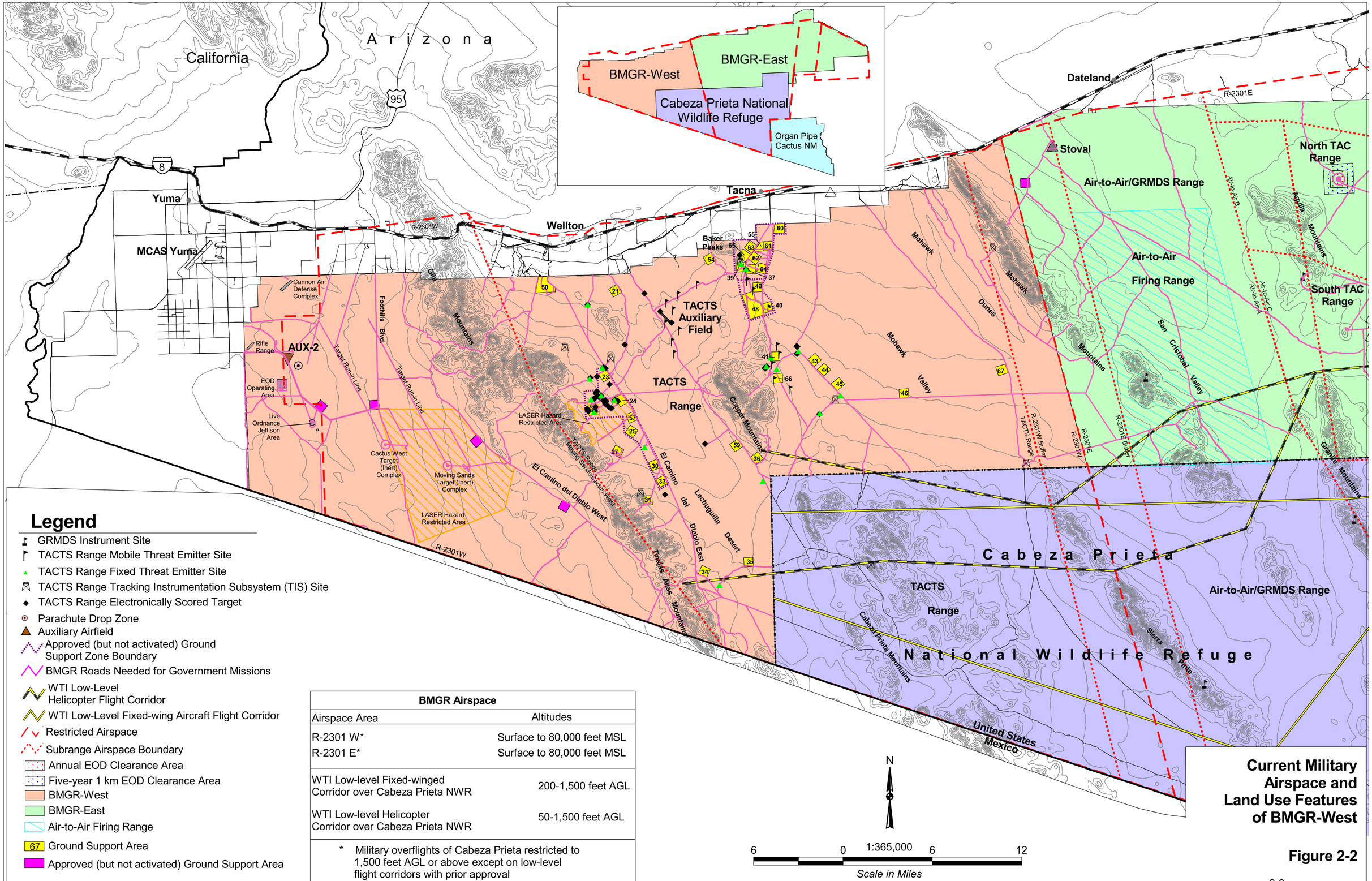
Airspace Legend

Airspace Area	Altitudes
R-2301 W*	Surface to 80,000 feet Above Mean Sea Level (MSL)
R-2301 E*	Surface to 80,000 feet MSL
R-2304	Surface to 24,000 feet MSL
R-2305	Surface to 24,000 feet MSL
WTI Low-level Fixed-winged Corridor over Cabeza Prieta NWR	200-1,500 feet Above Ground Level (AGL)
WTI Low-level Helicopter Corridor over Cabeza Prieta NWR	50-1,500 feet AGL

* Military overflights of Cabeza Prieta restricted to 1,500 feet AGL or above except on low-level flight corridors with prior approval

Current Military Airspace and Land Use Features of BMGR-East

Figure 2-1



BMGR Airspace	
Airspace Area	Altitudes
R-2301 W*	Surface to 80,000 feet MSL
R-2301 E*	Surface to 80,000 feet MSL
WTI Low-level Fixed-winged Corridor over Cabeza Prieta NWR	200-1,500 feet AGL
WTI Low-level Helicopter Corridor over Cabeza Prieta NWR	50-1,500 feet AGL

* Military overflights of Cabeza Prieta restricted to 1,500 feet AGL or above except on low-level flight corridors with prior approval

Current Military Airspace and Land Use Features of BMGR-West

Figure 2-2

2.2.1 East Tactical Range

Area Description. Includes all of the land area within the lateral airspace boundaries of East TAC Range that lie within BMGR—East (see Figure 2-1). East TAC underlies part of the R-2304 airspace.

Area Size. 177 square miles, or 113,520 acres.

Military Land Use—Air-to-Ground Weapons (Tactical) Range. East TAC Range supports approximately 34 identified target complexes for use in training aircrews to use gunnery, bombs, rockets, and missiles to attack enemy positions, equipment, and material. Nearly all of these targets are authorized for live-fire and two—HE Hill[12] and the live Maverick[13] air-to-ground (missile) target—are approved for armed (exploding) munitions. The targets are realistic simulations of tactical features such as airfields, railroad yards, missile emplacements, truck convoys, and battlefield tank formations.

The targets and their directly associated ordnance impact and laser hazard areas affect approximately 8,700 acres (or less than 8 percent) of the East TAC Range. Lasers, which function as part of the target sighting systems of some aircraft and munitions, are also employed in the East TAC Range (as well as North and South TAC ranges). These lasers could cause eye damage to surface users. The remainder of the land area lies within, between, or near the surface danger zones in which errant ordnance or laser energy may strike without harm to people or property. East TAC Range is configured to contain the surface danger zones (i.e., potential ordnance strike/blast or laser hazard areas) associated with its target complexes. The number of ordnance strikes falls off sharply with increasing distance from targets. However, all East TAC locations must be regarded as potentially hazardous during ordnance delivery training missions. Ground personnel are generally excluded from East TAC Range during live-fire training unless authorization has been obtained for personnel with a legitimate purpose to occupy a designated observation post. The entire TAC range must also be regarded as potentially contaminated with unexploded ordnance (UXO).[14] The vast majority of such contamination, however, is found in

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12 The three HE (high explosives) Hill targets on the BMGR are authorized for use with armed Mark (MK)-81, MK-82, MK-83, and MK-84 series of general purpose 250-, 500-, 1,000-, and 2,000-pound bombs. There is one HE Hill target in each TAC range.

13 The Maverick missile is a rocket-propelled antitank weapon that is precision-guided to the target by television, laser, or infrared tracking, depending on the model. The maximum attack range of the Maverick is about 13 nautical miles.

14 UXO refers to military munitions that have been primed, fused, armed, or otherwise prepared for action, and have been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard to operations, installation, personnel, or material and remain unexploded either by malfunction, design, or any other cause. Most of the expended munitions used currently (more than 99 percent, based on 1996 data) and in the past on the BMGR are training rather than warfighting rounds. Training munitions may include small explosive charges used to produce puffs of smoke to reveal the location hit when the bomb, rocket, or missile was delivered, but do not include high yield high explosives warheads. Training munitions may also contain propellants (such as solid fuel rocket or missile motors or "live" ammunition propellant cartridges (cannon or

close proximity to targets. East TAC Range is typically available (except for federal holidays) to support aircrew training from 7:00 a.m. to 11:00 p.m. local time Monday through Friday and from 8:00 a.m. to 5:00 p.m. local time on four weekend days per month.

Ongoing EOD programs to control surface build-up of expended munitions within BMGR weapons ranges are in place for both safety and environmental management purposes (Appendix B). EOD surface clearances are performed within East TAC Range (as well as North and South TAC ranges) according to criteria for both annual and five-year clearance schedules (AFI 13-212 Volume 1). The annual clearance criteria require that tactical range targets be cleared each year to a distance of 1,000 feet from the target. The five-year surface clearance criteria specify that targets be cleared of munitions to a distance of 1000 meters (3,280 feet), or to the distance at which the density of munitions on the surface is reduced to five complete ordnance items per acre, whichever is closer to the target. The five-year EOD clearance criteria of some individual targets within tactical ranges overlap because of the close proximity of these targets to each other. The 1,000-meter, five-year EOD clearance criteria were implemented Air Force wide in August 2001. These criteria are a reduction from the previous five-year clearance criteria that required munitions be cleared out to a distance of one nautical mile (6,080 feet), or further if necessary to reduce the density of munitions to less than five complete ordnance items per acre. The reduction in the five-year clearance distance resulted from the improved accuracy of aircraft weapons delivery systems, which has reduced the extent of target areas affected by munitions delivery training in contrast to that experienced with earlier types of aircraft and weapons systems.

Approximately 8,700 acres of East TAC Range are subject to annual EOD clearances and an additional 15,400 acres will be cleared every five years under the new 1,000-meter criteria. Approximately 34,400 acres of East TAC Range were subject to five-year EOD clearances under the previous one nautical mile criteria.

Surface Entry. All surface entry to East TAC Range by military and civilian personnel is controlled because of the safety hazards presented by the ongoing munitions delivery training missions performed in this tactical range and by the relatively high concentrations of UXO present on the ground surface. General public access to East TAC Range, and all other BMGR weapons ranges, is currently considered to be incompatible with the munitions delivery training mission and the prevailing levels of UXO surface contamination and is not permitted in accordance with AFI 13-212 Volume 1 Luke AFB Supplement 1. This official restriction on public access to BMGR—East weapons ranges—which includes all manned ranges, tactical ranges, and the air-to-air firing range—differs from some earlier official range access policies

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machine gun rounds), pyrotechnics (such as in flares), incendiaries (such as tracer rounds or white phosphorus) or other explosive agents. Expended training munitions that contain these substances because they failed to detonate, burn, or discharge are regarded as UXO because they have the potential to cause severe injury or death if they are disturbed or mishandled. Expended "live" warfighting munitions that failed to detonate, burn or discharge or did so incompletely are also regarded as UXO.

and unofficial range entry practices, but represents the Air Force's determination of the range security procedures that are currently needed to protect public safety and prevent interference with ongoing training and support missions.

Available Air Force records indicate that recreational use of BMGR weapons ranges was supported and controlled during non-training or EOD detonation periods in the 1980s through the range entry permit system (Air Force Regulation [AFR] 50-46 Luke AFB Supplement 1 1981 and U.S. Air Force 1986). By the early to mid-1990s, however, the Air Force determined that the difficulties associated with ensuring that visitors were clear of weapons ranges prior to the resumption of air-to-ground or air-to-air weapons training were too tenuous to adequately protect public safety and to avoid costly disruptions in training schedules. In addition, the hazards associated with the high concentrations of UXO, that are typically found on or near the ground surface within weapons ranges, reinforced the determination that recreational use of these ranges was incompatible with public safety requirements at all times. As a consequence, since 1994, all tactical, manned range, and air-to-air firing range areas within BMGR—East have been classified as reserved for military operations and other official duties only. The restrictions on general public access to all weapons range areas were published in each subsequent edition of AFI 13-212 Volume 1 Luke AFB Supplement 1, on official range maps issued with range entry permits or distributed in visitor information brochures, and in the LEIS for renewal of the BMGR land withdrawal (U.S. Air Force 1999).

This official restriction on public access to weapons ranges was subsequently enforced everywhere within BMGR—East with the exception of the Paradise Well area, which lies east of the Sand Tank Mountains in the easternmost portion of East TAC Range (see Figure 2-1). Enforcement of the restrictions on general public access to the Paradise Well area was inconsistent as both range security personnel at Gila Bend AFAF and BLM law-enforcement officers had the understanding that continuing the tradition of public access to this area was both safe and approved. Although the Paradise Well area is within East TAC Range, it is well outside of intended munitions impact areas associated with established targets and is generally not as contaminated with UXO as are the established areas. There are no road connections between the East TAC Range target areas and the Sand Tank Mountains and the potential for cross-country travel between these locations is disrupted by the rugged Sand Tank Mountains. The area was posted as a part of the BMGR with standard range access restrictions but was not identified as a part of East TAC Range to which higher levels of internal access restrictions applied. The Air Force reviewed the public access situation at the Paradise Well area in the fall of 2001. This review found that this location, which lies below restricted airspace reserved for East TAC Range operations, is frequently overflown by aircraft with armed weapons systems that are turning to deliver munitions on East TAC targets to the west. These munitions delivery overflights create the potential for the inadvertent release of munitions into the Paradise Well area. The Air Force concluded that the unofficial public access practices were not adequate for protecting public safety because of (1) the inadvertent munitions delivery potential, (2) the

remote location of the area makes it difficult to verify that it is clear of visitors prior to training missions, and (3) the levels of UXO contamination occurring there. The Air Force further determined that continuous restrictions on public access were necessary to provide for adequate public safety and to avoid interruption of flying missions due to the presence of unauthorized personnel underlying munitions delivery flight paths. The existing restrictions on public access to the Paradise Well area were reconfirmed in December 2001 and full enforcement of these restrictions was implemented. At the same time, range entry signs in this area were changed to advise persons that the Paradise Well area is a part of East TAC Range and is closed to public access.

Entry to East TAC Range is arranged for special purposes, such as scientific research, that are approved by the 56th RMO on a case by case basis in accordance with 56 RMO Operating Instruction 1-3, *Barry M. Goldwater Range [East] Permitting Process*. In accordance with the MLWA of 1999, Native Americans would also be allowed access to and ceremonial use of sacred sites, traditional plant gathering areas, and other places of cultural significance that may be located within East TAC Range, or other restricted BMGR—East locations, to the extent that such access is consistent with the military purposes for which such lands are withdrawn and reserved [P.L. 106-65 §3031(b)(3)(E)(ii)(II)]. Approved visits to East TAC Range, or other restricted BMGR—East locations, may require an official escort for safety purposes.

2.2.2 North and South Tactical Ranges

Area Description. Includes all of the land area within the lateral airspace boundaries of North and South TAC ranges (see Figure 2-1). North and South TAC ranges underlie part of the R-2301E airspace.

Area Size. 306 square miles, or 195,997 acres (116,843 acres in North TAC and 79,154 acres in South TAC).

Military Land Use—Air-to-Ground Weapons (Tactical) Ranges. North and South TAC ranges are directly analogous to East TAC Range. They serve the same aircrew training purposes as East TAC Range and feature similar target arrays. North TAC Range has approximately 20 identified target complexes; South TAC Range has approximately 17. There is one HE Hill target within each of these TAC ranges. A single live Maverick target is located in North TAC Range near its common boundary with South TAC Range. Ongoing EOD programs to control surface build-up of expended munitions currently subject a total of 17,747 acres of the North and South TAC ranges combined to annual EOD clearances and 26,600 acres to five-year EOD clearances.

The patterns of land use within North and South TAC ranges are also comparable to those in East TAC Range. The sizes and shapes of these ranges, the types of ordnance authorized for use, and the approved methods of delivery and target placement are collectively configured to contain all ordnance impact and blast effects. Nearly all ordnance strikes are on or near the designated targets. The greater land area reserved for these ranges is needed, however, to safely contain infrequent off-target ordnance impacts. All areas of North and South TAC ranges must be regarded as potentially hazardous during live-fire training missions. UXO could be encountered in surface or subsurface locations throughout these TAC ranges. The locations with the highest probability of such contamination, however, are in close proximity to targets.

Surface Entry. All surface entry to North and South TAC ranges by military and civilian personnel is controlled because of the safety hazards presented by the ongoing munitions delivery training missions performed in these tactical ranges and by the relatively high concentrations of UXO present on the ground surface. General public access to North and South TAC ranges is not permitted because it is incompatible with the current training mission and prevailing levels of UXO surface contamination. As described in Section 2.2.1, Native Americans will be provided with access to sacred sites, traditional plant gathering areas, and other places of cultural significance within North and South TAC ranges to the extent compatible with military training and support activities. Other members of the public may also enter these tactical ranges for special purposes that are approved in accordance with 56 RMO Operating Instruction 1-3, *Barry M. Goldwater Range [East] Permitting Process*, on a case by case basis. Approved visits may require an official escort for safety purposes.

2.2.3 Manned Ranges 1, 2, 3, and 4

Area Description. Includes the land area within the lateral airspace boundaries of Manned Ranges 1, 2, 3, and 4 (see Figure 2-1). Manned Ranges 1 to 4 underlie portions of the R-2301E, R-2304, and R-2305 airspace.

Area Size. 261 square miles, 166,960 acres.

Military Land Use—Air-to-Ground Weapons (Manned) Ranges. Each of the four parcels associated with the four manned ranges contains the air-to-ground target impact areas of the range and the surrounding area of land over which aircraft fly with armed weapons delivery systems. Each manned range has (1) two bull's-eye targets for training in conventional bombing and rocketry, (2) one bull's-eye target for training in simulated nuclear weapons delivery or conventional bombing, (3) one applied tactics target (a single target vehicle without a cleared area or bull's-eye) for conventional bombing or rocketry training, (4) one target for training in low-angle strafe, and (5) one tactical strafe target for low-angle strafe. Personnel are present in two observation towers at each manned range to control the movement of aircraft and the

delivery of munitions within the range and to score the accuracy of those deliveries. The accuracy of munitions deliveries can be scored on the conventional bombing and rocketry, simulated nuclear weapons delivery, low-angle strafe targets, and on the applied tactics targets, but not on the tactical strafe targets. Only inert munitions are used on the manned ranges. Ongoing EOD programs to control surface build-up of expended munitions currently subject 7,615 acres of land within Manned Ranges 1, 2, 3, and 4 to annual EOD clearances and 19,070 acres to five-year EOD clearances.

Surface Entry. All surface entry to Manned Ranges 1, 2, 3, and 4 by military and civilian personnel is controlled because of the safety hazards presented by the ongoing munitions delivery training missions performed in these ranges and by the relatively high concentrations of UXO present on the ground surface. General public access to Manned Ranges 1, 2, 3, and 4 is not permitted because it is incompatible with the current training mission and prevailing levels of UXO surface contamination. As described in Section 2.2.1, Native Americans will be provided with access to sacred sites, traditional plant gathering areas, and other places of cultural significance within Manned Ranges 1, 2, 3, and 4 to the extent compatible with military training and support activities. Other members of the public may also enter these manned ranges for special purposes that are approved in accordance with 56 RMO Operating Instruction 1-3 on a case by case basis. Approved visits may require an official escort for safety purposes.

2.2.4 Air-to-Air Firing Range

Area Description. Includes the ordnance and target fallout area[15] for the Air-to-Air Firing Range, located between the Aguila and Mohawk mountains within the R-2301E airspace (see Figure 2-1).

Area Size. 158 square miles, 101,040 acres.

Military Land Use—Air-to-Air Firing Range Munitions and Target Fallout Area. The designated lands serve as a fallout area for munitions expended in the overlying Air-to-Air Firing Range. Current munitions use is limited to 20 millimeter (mm) cannon rounds fired in air-to-air gunnery. Aerial Gunnery Target System[16] (AGTS) tow targets fall into this land area if the tow

[15] A fallout area is a term used to describe a designated land area within the BMGR that is used to receive expended air-to-air or surface-to-air munitions and aerial targets or target debris.

[16] The AGTS incorporates a towed banner target with an acoustical sensor that scores gunnery hits by counting the audible passage of cannon rounds through the banner material. The AGTS can be reeled in and recovered by the tow aircraft if the target has not been excessively damaged. The formerly used DARTs were rigged dart-shaped targets about 14 feet long and 4 feet across at the base. The cannon projectiles in each shooting aircraft were coated with a different color of paint that rubbed off on the DART as the round hit. Most DARTs were not lost over the range, but were jettisoned at a recovery area south of Gila Bend AFAF so that each shooter's score could be counted from among the colored hits.

cable is severed from the tow aircraft or the targets must be jettisoned because of gunnery damage.

Before the AGTS was employed for air-to-air training, Deployable Aerial Rigged Targets (or DARTs) were used as aerial tow targets. Large quantities of expended DARTs remain scattered throughout the land area underlying the Air-to-Air Firing Range. The 14-foot-long DARTs were designed to simulate an aircraft target.

Past training activities in the Air-to-Air Firing Range included regular use of live air-to-air missiles. This training activity typically included the launch of a 5-inch High Velocity Aircraft Rocket (HVAR) to serve as a target drone followed by the launch of a "Sidewinder" Air Intercept Missile (AIM) 9 (an infrared-guided missile) with a live HE warhead to intercept and destroy the HVAR. Some AIM-9 missile warheads failed to detonate during these training exercises and some HVAR or AIM-9 missile motors failed to ignite or burn completely. As a result, some HVARs or AIM-9s or other types of air-to-air ordnance are likely present as UXO on the ground surface below the Air-to-Air Firing Range and adjacent R-2301E airspace that was incorporated in the air-to-air firing area in years past. A survey of UXO concentrations below the Air-to-Air Firing Range and adjacent R-2301E airspace has not been completed nor has UXO disposal been undertaken because Air Force criteria for active range clearance activity does not require programmatic EOD clearances as described previously for other ranges.

Surface Entry. All surface entry to the Air-to-Air Firing Range fallout area by military and civilian personnel is controlled because of the safety hazards presented by the ongoing weapons training missions performed in this range and by the expected concentrations of UXO present on the ground surface. General public access to the Air-to-Air Firing Range impact area is not permitted because it is incompatible with the current training mission and probable levels of UXO surface contamination. As described in Section 2.2.1, Native Americans will be provided with access to sacred sites, traditional plant gathering areas, and other places of cultural significance within Air-to-Air Firing Range area to the extent compatible with military training and support activities. Other members of the public may also enter the Air-to-Air Firing Range area for special purposes that are approved in accordance with 56 RMO Operating Instruction 1-3 on a case by case basis. Approved visits will be scheduled only on days when air-to-air weapons use is not occurring and may require an official escort for safety purposes.

2.2.5 Goldwater Range Measurement and Debriefing System Range

Area Description. The GRMDS occupies an extensive block of airspace stretching across the lateral expanse of the R-2301E, R-2304, R-2305, and Sells Military Operations Area (MOA) airspace through which the relative flight paths and actions of appropriately equipped aircraft are electronically tracked and recorded.

Area Size. GRMDS coverage exceeds the area of BMGR—East, but each GRMDS electronic instrument site occupies only a few hundred square feet of land area.

Military Land Use—Electronic Instrument Sites. The GRMDS is composed of 17 ground-based, electronic instrument sites that are used to observe, measure, record, and replay the simultaneous actions of up to 36 aircraft participating in air-to-air training engagements. The GRMDS can also simulate air-to-air weapons use so that aircrews can realistically incorporate the use of aircraft weapons in their training without firing actual weapons. Nine of the instrument sites are located within BMGR—East, four are within the Cabeza Prieta NWR, and four are located east of the Tohono O'odham Nation on BLM and private lands. The extensive geographic coverage of the instrument sites provides the GRMDS with the capacity to support large-scale aircraft training operations. Fifteen of the 17 electronic instrument sites are tracking and instrumentation subsystem (TIS) stations, which are small and require a land area of no more that 15 feet by 15 feet. The TIS equipment is minimal, consisting of receiving and transmitting antennas, solar panel, enclosed electronic instruments, and a microwave transmitter. Most of the TIS stations are positioned within elevated mountain locations that are accessible for servicing only by helicopter (see Figure 2-1). These sites have been located where there is sufficient adjacent level ground for a safe helicopter landing area. The site on Childs Mountain within the Cabeza Prieta NWR is both a TIS and system master site that is electronically linked to all of the remote TIS sites and the GRMDS control center at Luke AFB by microwave transmission. A second master station is located east of the Tohono O'odham Nation on BLM land.

Surface Entry. Surface access by military or civilian personnel to the GRMDS instrument sites within BMGR—East is regulated by the access control procedures in effect for the specific location of the site. Access to GRMDS instrument sites is restricted to authorized service personnel. The public is restricted from these sites. These restrictions apply as well to instrument sites in off-range locations.

2.2.6 R-2301E, R-2304, and R-2305 Inter-range Safety Buffer Areas

Area Description. Includes BMGR—East lands that underlie R-2301E, R-2304, and R-2305 airspace but are outside of the tactical, manned, and air-to-air firing ranges.

Area Size. 882 square miles, or 564,215 acres.

Military Land Use—Potential Ordnance/Aerial Target Impact Area, Low-level Overflights, Stoval Outlying Auxiliary Airfield, Air Force Small Arms Range, Range Munitions Consolidation Points (RMCPs), EOD Training Range, and Access Control Areas. The three TAC ranges, four manned ranges, and Air-to-Air Firing Range are configured within BMGR—East to support

simultaneous training operations within all eight weapons ranges. Each range is of a size and shape designed to contain the weapons training activities it is designated to support. In addition, each of the eight ranges is positioned so that its flight operations can occur safely and cause the least amount of interference with the flexibility afforded to flight operations in the other ranges. As a result, the spacing of these weapons ranges in BMGR—East leaves intervening lands that are managed to:

- Serve as access control areas that could safely contain infrequent and unplanned impacts from unintentionally released ordnance or aerial targets without undue risk to people or property.

- Provide controlled access areas that can be readily incorporated into the safety buffers of existing weapons ranges or form a temporary safety buffer area to support irregularly scheduled training or test activities that would expose personnel on the ground surface to safety hazards. For example, North and South TAC ranges are frequently augmented through the addition of the Air-to-Air B and Air-to-Air C airspace to provide additional airspace in which aircraft can maneuver and reposition for munitions delivery training attacks on North or South TAC range targets.

- Support routine, low-level overflights by excluding incompatible land uses

- Support ongoing target maintenance and EOD functions

- Provide positive access control to the perimeters of existing weapons ranges

Developed facilities within the BMGR—East inter-range area include Stoval Auxiliary Airfield, the Air Force Small Arms Range, four RMCPs, and the Munitions Treatment Range (now used as the EOD Training Range, see Figure 2-1). Stoval Airfield is an unmanned outlying auxiliary airfield that was constructed to support training during World War II. The airfield consists of three approximately 150- to 3,700-foot runways laid out as an equilateral triangle with a parking apron appended to its northeastern facing side. Although this airfield has not been maintained and its macadam surface has deteriorated, Stoval Airfield continues to support periodic training activities requiring remote, primitive airfield conditions. One such activity is the semiannual Weapons Tactics Instructors (WTI) Course conducted by the Marine Corps that includes Marine air and ground units. Stoval Airfield is incorporated in the WTI Course as a deployment site for ground units performing air defense, communications, and command and control functions and as a location for conducting helicopter and C-130 aircraft operations from a forward airfield. The Marine Corps has completed environmental documentation to establish a new ground support area of up to 250 acres in size southwest of Stoval Airfield (U.S. Marine Corps 1997). The support area site is wholly within a previously disturbed Air Force test site that was active in the

late 1970s and early 1980s in association with the former MX (missile experimental, a type of Intercontinental Ballistic Missile) Missile development program.

The approximately three-acre Air Force Small Arms Range is located in the inter-range area west of State Route 85 and east of the White Hills. This facility is used for training security personnel in the use of small arms.

RMCPs 1, 2, 3, and 4 serve as range EOD and maintenance support areas for BMGR—East. Expended munitions and munitions scrap that is safe for handling is cleared from the three tactical and four manned ranges and transported to the RMCPs for demilitarization and decontamination processing before being released for off-range recycling or disposal (see Appendix B). Each RMCP is about 5.8 acres in size. Chain link fences topped with barbed wire enclose the perimeter of the RMCPs and entry is controlled through locked gates.

The EOD Training Range is located north of Manned Range 2 and a short distance south of the Manned Range 4 access road (see Figure 2-1). This facility occupies the detonation portion of a former Munitions Treatment Range that was inactivated in 1996. The training range is used for instructing EOD technicians in conducting safe detonations of UXO. Detonation of high-explosive charges weighing up to 2,000 pounds net explosive weight is authorized in this area.

Surface Entry. All surface entry by military and civilian personnel to the areas underlying R-2301E, R-2304, and R-2305 outside of the tactical, manned, and Air-to-Air Firing ranges is strictly controlled to prevent exposure to safety hazards presented by training or test missions or by elevated concentrations of UXO. General public access, with a valid range permit, is allowed only in the following four locations (see Figure 2-1). The Air Force reserves the right to close any of these areas to entry when necessary to support training missions.

- an area designated as Air Force Management Area B that is east of State Route 85 and south of the Sauceda Mountains
- a small area that is west of State Route 85 and east of Childs Mountain
- a small area in the vicinity of Bender Spring that is in a buffer zone between Paradise Well on East TAC Range and the northern BMGR boundary
- a loop road through the Mohawk Dunes west of the Air-to-Air Firing Range on the boundary with BMGR—West that provides access only for drive-through traffic

As a result of a 2001 Air Force safety review, general public access practices within BMGR—East to the west of the Air-to-Air Firing Range and the Mohawk Mountains have changed. The affected location is adjacent to BMGR—West and includes the BMGR—East area within the R-

2301E airspace buffer that is south of the Mohawk Mountains (see Figure 2-1). The aforementioned loop road is located in the northern portion of this area and crosses through the Mohawk Dunes. With the exception of the loop road, which is designed to accommodate drive-through traffic only (i.e., no backcountry hiking or overnight camping), this area is now closed to general public access to provide a buffer from weapons use within the Air-to-Air Firing Range.

As described in Section 2.2.1, Native Americans will be provided with access to sacred sites, traditional plant gathering areas, and other places of cultural significance within the otherwise restricted inter-range areas to the extent compatible with military training and support activities. Other members of the public may also enter these inter-range areas for special purposes that are approved in accordance with 56 RMO Operating Instruction 1-3 on a case by case basis. Approved visits will be scheduled only on days when conflicts with military activities will not occur. An official escort may be required to accompany the visiting party for safety purposes.

2.2.7 Gila Bend Air Force Auxiliary Field and Auxiliary Airfield-6

Area Description. Includes Gila Bend AFAF, AUX-6, and the adjacent BMGR—East lands east and west of State Route 85 and north of the R-2301E and R-2305 airspace areas.

Area Size. 41 square miles, or 26,125 acres.

Military Land Use—Gila Bend AFAF and Outlying Auxiliary Airfield Operations, Parachute Training Drop Zones, and Access and Encroachment Control. The lands north of the R-2301E and R-2305 airspace boundary are managed to control public access to Gila Bend AFAF, the primary parachute training drop zone (DZ), Manned Ranges 3 and 4, the Air Force Small Arms Range, and East TAC Range. Gila Bend AFAF includes a fixed-wing aircraft runway and a heliport. The 8,500-foot by 150-foot paved runway is used for emergency or precautionary recoveries of military aircraft that malfunction or are damaged during operations on the BMGR. The runway is also used daily by aircraft performing overhead approaches and patterns. The six-pad heliport is used routinely to support ARNG training operations. No aircraft are permanently based at Gila Bend AFAF.

Gila Bend AFAF is also used by F-16 and A-10 aircrews from Luke and Davis-Monthan AFBs and the Arizona ANG as an outlying field for practicing traffic pattern and emergency simulated flameout (engine power loss) procedures. The airfield is equipped with a simulated laser target (SLT) transmitter. A-10 aircrews use the SLT to practice illuminating a target with a weapons system aiming laser. No weapons are actually employed and no hazardous laser energy is emitted in this activity.

Helicopter aircrews from the WAATS and the ARNG 1/258th AHB use Gila Bend AFAF as a forward operating area to support live-fire training within North and East TAC ranges. WAATS and 1/258th AHB activities at Gila Bend AFAF include aircrew changes and helicopter refueling and rearming.

A control tower provides air traffic control whenever Gila Bend AFAF is open. Normal operating hours are 7 a.m. to 11 p.m. Monday through Friday. The auxiliary field is also equipped with a fire department, tie down ramp, munitions storage area, and aircraft hangar. Aircraft with malfunctions or damage are repaired at Gila Bend AFAF by maintenance crews that travel from their home base to the auxiliary field for each event.

The Range Operations Control Center (ROCC or Range Ops) for BMGR—East is located at Gila Bend AFAF. The ROCC is responsible for authorizing and coordinating all military and non-military aircraft entering and departing R-2301E, R-2304, and R-2305 airspace and surface users entering or departing BMGR—East. Gila Bend AFAF also houses support facilities for EOD, range control, maintenance, and security functions within BMGR—East and air traffic control, fire department, and flightline service for the airfield. Billeting for visiting personnel working temporarily on BMGR—East is also located at the airfield. The primary parachute training DZ is located about 3.5 miles west southwest of Gila Bend AFAF. An alternate parachute training DZ is located on the airfield.

Road access to Manned Range 3 and East TAC Range extends south and southeast from Gila Bend AFAF. The Air Force controls use of these roads to protect the safety of the public and military personnel and to prevent interruption of training operations.

AUX-6 is used on an irregular schedule throughout the year as a staging area or forward arming and refueling point for helicopter operations and as a field training/bivouac site for ARNG or Air Force Security Police units. AUX-6 is not used for munitions training by ground or air forces.

Surface Entry. All surface entry to Gila Bend AFAF, AUX-6, and the adjacent BMGR—East lands east and west of State Route 85 and north of the R-2301E and R-2305 airspace areas is controlled to provide security for these installations and to protect the safety of all military and civilian personnel. General public access to these areas is not permitted because it is incompatible with ongoing training or support missions. Members of the public can enter Gila Bend AFAF to obtain a BMGR Range Entry Permit from the Security Police Office for the purposes of visiting areas within the BMGR that are open to the public. Portions of Gila Bend AFAF are also open to recreational use by military personnel and military retirees. The installation maintains 41 family camping spaces with water and electrical hookups. As described in Section 2.2.1, Native Americans will be provided with access to sacred sites, traditional plant gathering areas, and other places of cultural significance within the otherwise restricted inter-range areas to the extent compatible with military training and support activities. Other members

of the public may also enter these inter-range areas for special purposes that are approved in accordance with 56 RMO Operating Instruction 1-3 on a case by case basis. Approved visits will be scheduled only on days when conflicts with military activities will not occur. An official escort may be required to accompany the visiting party for safety purposes.

2.2.8 Ground Support Areas and TACTS Range

Area Description. Includes the BMGR—West lands east of the Gila and Tinajas Altas mountains.

Area Size. 674 square miles, or 431,642 acres.

Military Land Use—Ground Support Areas, TACTS Range Facilities, Surface-to-Air Firing Range, and Standoff Air-to-Surface Weapons Range. This area serves a mix of Marine Corps and Navy training purposes within BMGR—West (see Figure 2-2). A regularly scheduled Marine Corps use of the area is for ground troop deployments in support of the semiannual WTI Course. Marine air defense, air control, communications, and command units select among 35 existing ground support areas as sites from which they may perform their missions. Although the aggregate area of the 35 current sites and the four approved, but as yet unused support areas, is only about two percent of the total area of BMGR—West east of the Gila and Tinajas Altas mountains, the distribution of all 39 existing and approved support areas provides ground units with positions that are tactically realistic for the WTI training scenario. Marine Corps ground units also use the ground support areas for training at other times.

The Yuma Training Range Complex (YTRC) EIS (U.S. Marine Corps 1997) includes environmental documentation for establishing four new ground support areas and three new ground support zones within BMGR—West (see Figure 2-2). Each of the three new ground support zones encompasses several of the existing ground support areas. Although the zones have been approved, the Marine Corps continues to restrict ground units to the previous ground support areas. The current intent of the Marine Corps is to continue to rely upon the ground support areas for training deployments until such time that changes in the training scenario, weapons, or warfighting tactics dictate a need to use different locations within the zones. New locations within the zones would also be selected for ground unit deployments to replace current ground support areas that prove to have insufficient soil-bearing strength to support training activities without suffering unacceptable erosional effects. In circumstances such as this, a support zone location with acceptable soil characteristics would be identified to replace the former support area.

The TACTS Range, which has nine remote TIS stations and one TIS/master station, is directly analogous to the GRMDS within BMGR—East in terms of subsystem components for

supporting training in air-to-air combat. Eight of the TACTS TIS stations are located within BMGR—West, one is within the Cabeza Prieta NWR, and the TIS/master station is located within BMGR—West at Baker Peaks (see Figure 2-2). The TACTS Range also has the components necessary to simulate both air-to-ground weapons delivery missions and surface-to-air missile threats.

The air-to-ground weapons delivery component of the TACTS Range is supported by 112 individual passive tactical target sites situated in 11 complexes that simulate airfield installations, power stations, fuel storage facilities, buildings, railway facilities, anti-aircraft missile and gun positions, and military vehicles. Aircrews training in air-to-ground weapons delivery maneuver their aircraft as to attack these targets but neither carry nor release actual munitions. Instead, electronic pulses (rather than actual ordnance drops) are used to simulate the trajectories of munitions. As a result, there are no munitions impact areas. The probable success of the intended attack is generated and scored via computer simulation. The TACTS Range is also configured to accommodate the use of airborne targeting lasers to designate the target intended for attack, but only for targets within the main airfield complex about 11 miles south of Wellton, Arizona. The targeting lasers used are not eye safe and could cause eye injury or blindness if an observer looks directly into the laser light. The area approved for laser use is posted as a laser hazard area (see Figure 2-2) and no personnel are allowed to enter this area when it is active without eye protection that is approved for the specific type of laser in use.

Seventeen mobile and 18 fixed electronic threat emitter sites are located adjacent to existing roads within BMGR—West east of the Gila and Tinajas Altas mountains. Threat emitter sites are locations where electronic equipment that transmits tracking and targeting radars to simulate surface-to-air antiaircraft missiles is periodically operated or permanently installed. Controllers operate the threat emitters to challenge aircrews training within the TACTS Range with realistic air defense threats.

The radar energy transmitted by the threat emitters is sufficient to be a radiation burn hazard to people close to the transmitter and in the path of the transmitted energy. Personnel on the ground at active mobile threat emitter sites keep people clear of hazardous areas associated with the emitter equipment. The fixed threat emitter transmitters are sufficiently elevated to ensure that no emitted energy can strike the ground at a range any less than that needed to attenuate the energy to a safe level. The fixed emitters are posted and fenced within an area of about 40 feet by 40 feet to keep people and large mammals (e.g., Sonoran pronghorn) a safe distance from the site. Power for the fixed emitters is provided at each site by a twenty kilowatt, liquid petroleum gas (LPG) fired generator. These emitters are operated remotely by microwave signals from TACTS Range controllers. No personnel are on site. The generators produce 40 decibels (A-weighted, or dBA) of acoustical energy (or noise) at a radius of 90 feet. This noise level is equivalent to that of a quiet private office. The fixed generators/threat emitters are typically operated for about 40 hours per month.

The Surface-to-Air Missile (SAM) Firing Range lies east of the Baker Peaks and Copper Mountains. The firing direction is to the southeast across the Mohawk Valley. Although this firing range has been inactive since 1999, it was used annually to support a live-fire validation test of the HAWK[17] surface-to-air missile system from 1980 until its retirement after 1998. The same area was also used for firing Stinger surface-to-air missiles. The Stinger firings usually occurred coincident with the HAWK missile exercise period. Both weapon systems were fired at target drones. All access to the test land area was suspended during the test period to protect the safety of civilians and military personnel and to prevent interruption of the test program. Units participating in or supporting the SAM firings occupied the ground support areas located on the east side of the Baker Peaks and Copper Mountains during the firing exercises. Future use of the Baker Peaks SAM range will probably not include the HAWK surface-to-air missile system but could involve firing Stinger missiles or other types of SAMs.

The area of BMGR—West that is east of the Gila and Tinajas Altas mountains has a potential future role as a surface danger zone that would underlie the trajectories of standoff air-to-ground weapons. Current standoff weapons carried on tactical aircraft include glide bombs, such as the Joint Direct Attack Munition (JDAM). Air-to-ground missiles fired from tactical aircraft can be launched at distances of up to tens of miles from the intended target. Weapons with increasingly longer standoff range are under development. Although no plans have yet been developed to use the BMGR as a training or test site for such weapons, the range has the capacity to accommodate this type of use. A likely scenario for standoff weapons training on the BMGR would include the launch or release of the weapon from the aircraft within R-2301W with the intent of an impact within North or South TAC ranges. Under these circumstances, the area of BMGR—West that is east of the Gila and Tinajas Altas mountains would serve as a safety buffer zone that could receive munition impacts as a result of a malfunction in the weapon system or error in the delivery process. Access to those portions of the BMGR that could potentially be impacted by an errant standoff weapon would have to be suspended during training periods.

Surface Entry. At most times, there is no requirement to restrict military or civilian personnel from entering most locations within the area of BMGR—West east of the Gila and Tinajas Altas mountains (see Figure 2-2). The exceptions include TACTS Range electronic instrument sites, and target simulation and laser hazard areas, which are off limits to all persons that are not specifically authorized with access to these locations. Ground unit deployments (for other than missile firings) require that access to BMGR—West be restricted only within ground areas occupied by troops to protect the safety of both participating and nonparticipating personnel and to prevent disruption of the training exercise. Future SAM firings or standoff weapons use would require that much larger areas of BMGR—West be closed to entry during the affected training periods. General public access to the area of BMGR—West that is east of the Gila and

[17] The official name of the HAWK missile is an acronym meaning Homing All the Way Killer, a reference to the missile's on-board radar tracking system that guides the weapon to the target.

Tinajas Altas mountains is currently permitted at most times because it is compatible with the regularly scheduled ongoing training missions. Native Americans will be provided with access to sacred sites, traditional plant gathering areas, and other places of cultural significance within otherwise restricted access areas located east of the Gila and Tinajas Altas mountains to the extent compatible with military training and support activities. Approved visits will be scheduled only on days when conflicts with military activities will not occur. An official escort may be required to accompany the visiting party for safety purposes.

2.2.9 Moving Sands and Cactus West Target Complexes, Auxiliary Airfield-2, and Cannon Air Defense Complex

Area Description. Includes the BMGR—West lands west of the Gila and Tinajas Altas mountains.

Area Size. 248 square miles, or 158,688 acres.

Military Land Use—Moving Sands and Cactus West Target Complexes, AUX-2, Parachute Drop Zone, Ground Support Areas, Rifle and Pistol Range, Cannon Air Defense Complex, EOD Operating Area, and Live Ordnance Jettison Area. The area of BMGR—West west of the Gila and Tinajas Altas mountains currently supports six types of training facilities and two training support areas (see Figure 2-2). The training facilities include the Moving Sands and Cactus West target complexes, AUX-2, a parachute DZ, four approved ground support areas, a rifle range, and the Cannon Air Defense Complex. The two training support areas include an EOD operating area and a live ordnance jettison area.

The Moving Sands and Cactus West target complexes provide a variety of scored air-to-ground targets for bombing, rocketry, and strafing. Ordnance deliveries on both complexes are restricted to the use of inert training practice munitions of up to 1,000 pounds. Both the Moving Sands and Cactus West complexes include circular target areas of 1,500 feet in radius for training in conventional bombing and rocketry and separate targets for training in low-angle strafing. The Moving Sands complex also contains a Mobile Land Target (MLT). The MLT is a remotely controlled movable target that runs in a racetrack pattern and can be operated at various speeds up to 50 miles per hour.

The Cactus West conventional target is a bull's-eye type of target designed to provide aircrews with training in the basic mechanics of delivering air-to-ground ordnance in a structured and tightly controlled target setting. The Moving Sands conventional bull's-eye was reconfigured in the late 1990s to represent a developed urban site with simulated streets and buildings set within the original 1,500-foot radius circular impact area. This target was reconfigured for the purpose of training aircrews in the difficult challenge of engaging targets in an urban environment. The

Moving Sands urban target is also approved for air-to-ground laser use for designating targets. A posted laser hazard area extends around this target to warn surface users not to enter this area because of the risk of eye damage (see Figure 2-2). Both target complexes are equipped with lighting for night operations, a radar reflector, and a distance-marked 11.2-mile-long run-in line. The run-in line, however, is no longer required for training purposes. Hits on the bombing/rocketry targets at the Cactus West Range are scored by a Weapons Impact Scoring System[18] (WISS). Training use on a portion of the Moving Sands urban target is also supported by a WISS. The strafing targets on both ranges are scored acoustically; the MLT on the Moving Sands range is not scored.

AUX-2 is a small, outlying airfield remaining from the World War II training era. The basic airfield structure of AUX-2 is that of an equilateral triangle of about 3,700 feet on a side. The original east-west oriented runway of AUX-2 has been redeveloped with aluminum runway matting and a landing control tower to resemble the deck and control island of a U.S. Navy Landing Helicopter Assault (LHA) ship. This LHA deck is used to train and refresh helicopter and AV-8B aircrews in the basic flight mechanics and visual references used for landing, taking off, and taxiing their aircraft aboard an LHA ship.

A second northeast-southwest oriented runway serves as a 4,000-foot-long landing strip, known as a tactical landing zone (TLZ). The TLZ is used to train C-130 transport aircrews in landings and takeoffs from narrow, unimproved, and even improvised forward airfields. The third leg of the triangle is a range access road.

Construction of a new hard-surfaced runway at AUX-2 to support AV-8B training in narrow-width roadway operations (also called road ops) was addressed in the YTRC EIS (U.S. Marine Corps 1997) and has been approved, but has not yet been implemented. This runway is planned to be parallel to, and on the western side of, the present TLZ. This runway would be 4,200 feet long by 34 feet wide, and have concrete vertical take-off and landing pads at each end.

The TLZ also serves as a DZ for tow banners used by the Marine Corps as aerial gunnery targets within the Chocolate Mountain Aerial Bombing and Gunnery Range in southeastern California. Tow banners are collected for scoring by ground personnel. A tow cable cutter is located about 2,000 feet south of the southwest end of the TLZ.

A parachute DZ used for training C-130 aircrews to perform cargo parachute drops is presently located a short distance southeast of AUX-2 at the inactive Rakish Litter target bull's-eye (see Figure 2-2). A tactical forklift vehicle is used to recover the cargo pallets dropped in this training.

[18] WISS is basically an automated television camera/computer system that detects and triangulates the locations of bomb hits within the target impact areas.

Four new ground support areas for troop deployments have been approved but not implemented for the area of BMGR—West west of the Gila and Tinajas Altas mountains to support the WTI Course. The approximate locations of the new support areas have been identified; these positions could be adjusted, however, if relocation is warranted by the findings of pending cultural resource surveys of the sites.

The rifle and pistol range is located just inside the BMGR entrance gate at Yuma County 19th Street. This entrance also provides access to AUX-2 and the Moving Sands and Cactus West target complexes (see Figure 2-2). The rifle range has 30 firing lanes and is used by MCAS Yuma personnel to meet proficiency requirements for the use of small arms.

The Cannon Air Defense Complex, located in the northwest corner of the BMGR, provides administrative, support, and training areas for a Marine Air Control Squadron (see Figure 2-2). The complex is a permanent facility of about 0.3 square miles in size with a developed cantonment area. The perimeter is fenced to deter unauthorized access.

The EOD operating area is positioned close to and southwest of AUX-2. This area, which is operated under a Resource Conservation and Recovery Act (RCRA) Part B interim permit[19], has the dual purpose of providing for EOD training and for disposing of munitions with expired shelf-lives. Both open burn and open detonation techniques are employed. The second area, located about 5 miles west northwest of the Cactus West target bull's-eye, is used as a jettison area for aircraft that need to safely release live but unarmed ordnance or drop tanks.[20]

The live ordnance jettison area is the old bull's-eye of the former Panel Stager target. This target was inactivated in 1986 when it was replaced by the new Moving Sands and Cactus West target complexes. Aircrews carrying live but unarmed ordnance are directed to this site when an in-flight malfunction requires the jettisoning of the munitions, or other external stores such as fuel tanks, prior to a precautionary recovery of their aircraft at MCAS Yuma. EOD personnel are tasked to recover jettisoned bombs and dropped fuel tanks following each release event. Any fuel spills at this site, or at any other BMGR location, are addressed according to the current Spill Response Plan[21] and through consultations with the Arizona Department of Environmental Quality.

Surface Entry. Entry to the portion of BMGR—West that is west of the Gila and Tinajas Altas mountains and also west of the extension of Foothills Boulevard and the western alignment of El

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[19] The RCRA Part B interim permit is available for public review at the MCAS Yuma Environmental Office during regular business hours.

[20] A drop tank is an aerodynamically shaped fuel tank that is carried externally by an aircraft on the underside of the fuselage or wings to extend its flight range. Drop tanks can be jettisoned in an emergency to reduce the aerodynamic drag and weight of the aircraft or to eliminate explosive quantities of fuel.

[21] The Spill Response Plan is available for public review at the MCAS Yuma Environmental Office during regular business hours.

Camino del Diablo is restricted at all times to authorized personnel (see Figure 2-2). This portion of the range includes the Moving Sands and Cactus West target complexes and laser hazard area, live ordnance jettison area, AUX-2, EOD operating area, rifle and pistol range, parachute DZ, and Cannon Air Defense Complex. Hazards and/or security issues associated with these locations and the need to prevent unauthorized entry from disrupting ongoing training require that entry be restricted. Public recreation is not permitted within this area. Native Americans will be provided with access to sacred sites, traditional plant gathering areas, and other places of cultural significance within otherwise restricted access areas located west of the Gila and Tinajas Altas mountains to the extent compatible with military training and support activities. Other members of the public with a legitimate need to visit this area for special purposes will also be accommodated on a similar basis. Requests for visits to these locations will be approved by the Range Management Department at MCAS Yuma on a case-by-case basis. Approved visits will be scheduled only on days when conflicts with military activities will not occur. An official escort may be required to accompany the visiting party for safety purposes.

General public access to the portion of BMGR—West that is west of the Gila and Tinajas Altas mountains but east of the extension of Foothills Boulevard and the western alignment of El Camino del Diablo is generally not restricted (see Figure 2-2). Requirements for temporary restrictions on entry to this area to support special training activities are implemented on an event by event basis.

2.3 BMGR HISTORY

The land acquisition, military use, and resource use and management histories of the BMGR are summarized here to describe the stage upon which future management of the range environment will be directed. The land acquisition history for the BMGR, which dates from 1941, includes a long and complex series of land withdrawals and state and private land purchases. The acquisition history of the range is pertinent to the development of the draft EIS for the proposed INRMP in that it identifies the time period over which the various properties within the range have been subject to military use, restrictions on non-military land use, and various forms of management. The account of military land use adds to the acquisition history by defining how BMGR lands have been previously used for military purposes. This information is important for at least three reasons. First, constraints on some land or management activities may be necessary because of the known or potential presence of UXO on or below the ground surface. Second, the extent to which ground surfaces or natural biological communities may have been disrupted by former military activities may provide a gauge for assessing the effects of such activities and the effectiveness of either natural or management-induced restoration. Third, historical information is necessary to analyze cumulative impacts over time, as required by NEPA. The resource use and management history of the BMGR is similarly valuable for providing information on the

extent to which the range environment has been previously affected by non-military use and the effectiveness of former management actions.

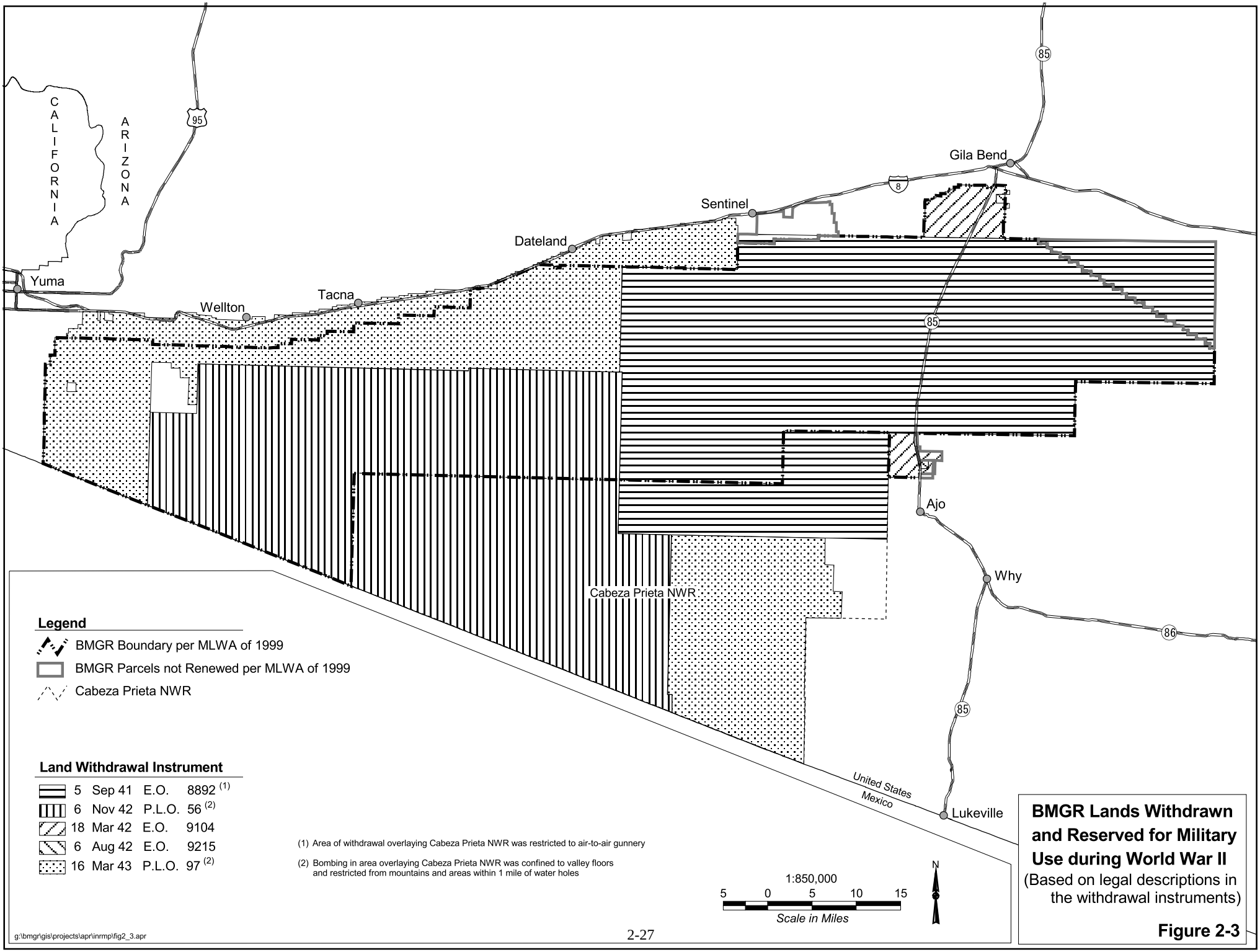
2.3.1 Acquisition

Acquisition of the BMGR for military aviation training purposes began barely three months before the United States entered World War II after the Japanese attacked Pearl Harbor on 7 December 1941. The first 1,077,500 acres of the range (known then as the Gila Bend Gunnery Range) were withdrawn by Executive Order 8892 signed by President Franklin D. Roosevelt on 5 September 1941 (U.S. Air Force 1986) (Figure 2-3). This step was just one of a great many taken to create military bases and training ranges across the Nation prior to and during World War II. In Arizona alone, 22 military airfields and three bombing and gunnery ranges were established from 1940 through 1943. During this period, four additional parcels were added to the BMGR land withdrawal through either executive order (E.O.) or public land order (P.L.O)[22] (Table 2-1). The last World War II addition, on 16 March 1943, raised the range to its full wartime land area of 2,776,968 acres (4,330 square miles).

The statutory authority cited by President Roosevelt for creating the Gila Bend Gunnery Range and many other military reservations by executive order alone was found in an Army appropriations act of 1918 with only one relevant line stating "That by order of the President, any Government property or unappropriated or reserved public lands may be reserved from entry, designated, and used for such aviation stations or fields for testing and experimental work …" (U.S. Air Force 1986). This Presidential power was later taken away by Congress, which reserved for itself the sole authority to enact land withdrawals for military purposes that are more than 5,000 acres in aggregate through the passage of the Defense Withdrawal Act of 1958 (P.L. 85-337), also known as the Engle Act.

Lands incorporated in the range during World War II included all of the properties presently within the BMGR plus about 95 percent of the Cabeza Prieta NWR (known then as the Cabeza Prieta Game Range); the Sand Tank Mountains, Ajo Airport, and Interstate 8 vicinity properties removed from the range by the MLWA of 1999 (see Figure 1-1); and lands contiguous to the northern boundary of BMGR—West and northwestern BMGR—East that were removed from

[22] Public land orders may be implemented at the direction of the President by his designees. In the case of the BMGR, President Roosevelt, through E.O. 9146 (dated 24 April 1942), delegated to his Secretary of the Interior, the authority to issue P.L.O.s pertaining to Department of the Interior lands.



BMGR Lands Withdrawn and Reserved for Military Use during World War II
(Based on legal descriptions in the withdrawal instruments)

Figure 2-3

TABLE 2-1

LAND ACQUISITION HISTORY FOR THE BMGR

Legal Instrument	Date	Acreage	Description
E.O. 8892	5 Sep 41	1,077,500	Established range: tract included most of the current BMGR—East and northwest area of Cabeza Prieta NWR
E.O. 9104	18 Mar 42	45,168	Expanded range: included three widely separated tracts - Gila Bend AFAF and AUX-6 area; Ajo Auxiliary Army Airfield area; and a tract in the northwestern portion of the range in the vicinity of the Gila Mountains
P.L.O. 56	6 Nov 42	949,000	Expanded range: included southwestern portion of current BMGR—East, all but the most northern and western portion of current BMGR—West, and western portion of Cabeza Prieta NWR
P.L.O. 97	16 Mar 43	705,300	Expanded range: included northwestern portion of current BMGR—East, northern and westernmost portions of current BMGR—West, many thousands of acres north of the current northern boundaries of BMGR—West, and the southeastern portion of the Cabeza Prieta NWR.
Total World War II Withdrawals(4)	5 Sep 41 – 16 Mar 43	2,776,968	Maximum extent of World War II range land area
Transfer	1946	-640	Reduced range: Ajo Auxiliary Army Airfield was inactivated and the property was transferred from the range to Pima County for public use as the Ajo Municipal Airport
P.L.O. 512	August 48	-45,168	Reduced range: this P.L.O. revoked P.L.O. 9104
P.L.O. 652	26 Jun 50	43,895	Re-expanded range: returned to the range all but 1,273 of the 45,168 acres deleted by P.L.O. 512
P.L.O. 680	27 Oct 50	-556,200	Reduced range: this P.L.O. revoked the withdrawal of all but 149,100 acres withdrawn under P.L.O. 97 and opened the affected lands to homesteading by qualified veterans. Area affected included northwestern portion of current BMGR—East near Stoval Airfield, northern and western portion of current BMGR—West boundary, and southeastern portion of Cabeza Prieta NWR
Special Land Use Permits AR 04214 and AR 032722	8 Apr 53 – 8 Apr 78 in five-year increments	17,131	Expanded range: leased BLM lands south of Sentinel, Arizona, to Air Force to buffer now inactive target sites and Manned Range 4
Department of the Interior Letter	27 Oct 52	2,106,902	Continued range: letter extended existing withdrawals indefinitely pending issuance of a P.L.O., which was never forthcoming

TABLE 2-1

LAND ACQUISITION HISTORY FOR THE BMGR

Legal Instrument	Date	Acreage	Description
P.L. 87-597 (76 Stat. 399)	24 Aug 62	Tract A 140,570 Tract B 345,091	Re-expanded range: returned to the range all but 70,539 of the 556,200 acres deleted by P.L.O. 680, Tract A was in the southeastern portion of the Cabeza Prieta NWR and Tract B was in the western and northern sections of the current BMGR—West
P.L.O. 5324	21 Dec 72	479,100	Continued range: P.L.O. extended withdrawals under P.L. 87-597 for five years until 24 Aug 1977
Proposed Withdrawal and FLPMA	5 May 77	502,792	Continued range: proposed legislative renewal of lands withdrawn under P.L. 87-597 and leased under AR 04214 and AR 032722, extends effect of withdrawals until 5 May 79
FLPMA	6 May 79	2,664,432	Continued range: FLPMA continues all withdrawals then in effect until otherwise modified under its provisions or other applicable law
Proposed Withdrawal and FLPMA	15 Dec 81	2,664,432	Continued range: proposed legislative renewal of all range land withdrawals plus lands formerly leased under AR 04214 and AR 032722, extends withdrawal effect to all properties proposed for withdrawal
P.L. 99-606	6 Nov 86	2,668,100	Continued range: legislative withdrawal and reservation of BMGR for military purposes for 15 years; first range withdrawal in one consolidated legal instrument
Purchase	1986 - 1999	83,721	Continued range: 83,721 acres of state trust and private lands within the boundary of the BMGR were purchased by the DoD during this period to eliminate the need to secure the use of these lands for military purposes through ongoing lease or lease-condemnation processes.
P.L. 106-65	5 Oct 99	1,650,200	Continued but reduced range: legislative withdrawal and reservation of BMGR for military purposes for 25 years, range land area reduced from 2,668,100 acres to 1,650,200 withdrawn acres because of the non-renewal of Cabeza Prieta NWR, Sand Tank Mountains area, Ajo Airport area, Sentinel Plain area, and Interstate 8 vicinity area.
Total Current Acquisitions	5 Oct 99 - present	1,733,921	The 1,650,200 acres withdrawn from the public domain by the MLWA of 1999 plus the addition of 83,721 acres of former state and private lands purchased by DoD brings the total range area to 1,733,921 acres.

Sources: U.S. Air Force 1986, MLWA of 1986, and MLWA of 1999.

the range in October 1950 (U.S. Air Force 1986). The Sentinel Plain area (see Figure 1-1), which was also removed from the BMGR by the MLWA of 1999, was not included in the range until 1953.[23]

In 1946, the year after the end of World War II, military ranges and airfields throughout the country were closed or inactivated, including all of the military airfields in Arizona except Williams and Davis-Monthan Army airfields (redesignated as Air Force bases in 1948). Control of the gunnery range passed to Williams AFB at this time. The range fell into a period of low or non-activity for several years following the war. The outbreak of the Korean War and the growing press of the Cold War, however, prompted reactivation of the gunnery range, Luke AFB (formerly Luke Field), Gila Bend AFAF at the gunnery range, and Yuma Air Base[24] (formerly Yuma Army Airfield) in early 1951 (Keane and others 1997). The Presidential authorizations for the gunnery range during World War II had included expiration provisions that would be triggered six months after the termination of the unlimited national emergency proclaimed by President Roosevelt on 27 May 1941 as the Nation faced the growing threat of war (U.S. Air Force 1986). That unlimited national emergency was proclaimed terminated on 28 April 1952 by President Harry S. Truman following the Treaty of Peace with Japan that was brought into force on 8 September 1951 (Proclamation No. 2974, CFR 158 [1952]). Without the reactivation of the gunnery range necessary for Korean and Cold War training, jurisdiction of the various withdrawals and leased range land parcels would have reverted to the BLM, Bureau of Reclamation, State of Arizona, and private owners. Authorization for continued use of the gunnery range lands was issued on 27 October 1952 from the Office of the Secretary of the Interior via a letter sent to the Secretary of the Air Force the day before World War II era executive orders and public land orders were scheduled to expire (U.S. Air Force 1986). The letter was issued pending the issuance of a new public land order to formalize the continuing withdrawal of the range lands for military purposes. Although that public land order was never forthcoming, the range withdrawals continued to remain in force by other mechanisms until the passage of the MLWA of 1986, which granted a 15-year withdrawal of the BMGR for military purposes in a single legal instrument. That process was repeated by Congress 13 years later with the passage of the MLWA of 1999 that renewed the BMGR land withdrawal, with a reduced land area, for 25 years until 2024.

Lands belonging either to the State of Arizona or under private ownership were included within the boundaries established for the range during World War II. Continued use of these lands by

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[23] The Sentinel Plain area was originally made a part of the range through special land use permits issued by the BLM (Serial Numbers AR 04214 and AR 032722) rather than through a withdrawal and reservation process. Apparently, the Air Force requested the special land use permits, which could be issued quickly by the local BLM office, to provide a buffer area for now inactive napalm and simulated convoy targets situated close to the northern range boundary south of Sentinel (U.S. Air Force 1986). The Sentinel Plain area was finally incorporated into the range land withdrawal by the MLWA of 1986 but was later removed from the BMGR by the MLWA of 1999.

[24] Yuma Air Base was redesignated as Vincent AFB in 1956. Vincent AFB became Marine Corps Auxiliary Air Station, Vincent Field, Yuma in 1959 and Marine Corps Air Station Yuma in 1962.

the state or private owners was deemed to be incompatible with the intended use of the new range as an aircraft weapons training area for military aircrews. Consequently, the affected state trust lands[25] were secured for military use by a lease-condemnation process while private properties were secured by lease only with the cooperation of the landowner or, when necessary, by lease-condemnation. Annual lease fees were paid to the state and private landowners for the use of these properties. Over the years, a program that exchanged federal land outside of the range for state trust or private lands inside the range on a dollar value basis reduced the volume of these inholdings; however, 83,721 acres of these properties remained within the BMGR after the MLWA of 1986. The inholdings were finally purchased by DoD prior to the passage of the MLWA of 1999.

2.3.2 Historical Military Use

The BMGR was initially established in the fall of 1941 to support the Army Air Force[26] flying training programs at Luke Field (Luke AFB after 1 January 1951) and Williams Field (Williams AFB after 1947) that had begun flying operations in June 1941 (Keane and others 1997). The range was needed primarily for aerial gunnery training, but was also used for bombing training. The first parcel of land selected for the range had three key characteristics critical to its intended mission. First, located southeast to southwest of Gila Bend, the new range would be in close flying proximity to Luke and Williams fields (straight line flying distances of about 52 and 69 miles respectively). Second, except for some scattered ranches and mines, the land was uninhabited and undeveloped. Third, at 1,077,500 acres (1,684 square miles), the initial range tract was large enough to be subdivided into several separate training areas that could safely support several simultaneous but independent training missions, which added significantly to the productivity of the overall training program. The continued proximity of the BMGR to military air bases and its size continue to be two of the most important assets of the range for supporting contemporary military training. Military use has continued to preclude habitation and development of the range except for infrastructure needed for military training.

Although starting at 1,077,500 acres, the range was already expansive; land continued to be added to the complex until it reached the full World War II era size of 2,776,968 acres (see Table 2-1). These additions were required to give the range the needed training capacity to produce qualified aircrews for the Nation's war effort. The western land areas of the range were added to

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[25] Most of these properties were lands held in trust for the state for the benefit of the public schools and some other public institutions such as universities and penitentiaries. State trust lands are administered by the Arizona State Land Department with the goal of maximizing revenues for the trust beneficiaries. Lease-condemnation was necessary to secure trust lands for federal military use because the state was required by law to consider the highest revenue generating use for these properties.

[26] The U.S. Air Force was established as an independent service on 18 September 1947. The Air Force evolved from the Army Air Service which became the Army Air Corps in 1926, which in turn became the Army Air Force in June 1941.

support flight training programs at Yuma Army Air Base. Flight training was already underway at Yuma Army Air Base, which had opened for operations on 29 June 1942, when the western extent of the range land area was added in November 1942 and March 1943 (see Table 2-1 and Figure 2-3). The development of Yuma Army Air Base as a training command separate from those at Luke and Williams fields and the addition of the western parcels to the gunnery and bombing range established a second area of aircrew training operations that were independent from those conducted in the eastern range areas. By the close of 1942, the eastern and western range components were known as the "Gila Bend Gunnery Range" and "Yuma Aerial Gunnery and Bombing Range," respectively.[27] By providing additional multiple locations for further subrange development, the east-west division of the range proved to be an effective means of maximizing the types and volume of training benefits that could be achieved from the withdrawn lands. This basic east-west split of range resources has been continued ever since and is currently represented by the BMGR—East and BMGR—West divisions of the range.

Starting with these initial World War II range use activities, development and use of the BMGR to support military training can be roughly separated into five historic eras that are applicable to both the eastern and western components of the range. These development/use eras include:

- World War II Era, 1941 to 1949
- Korean War and Early Cold War Era, 1950 to 1959
- Middle Cold War and Vietnam War Era, 1960 to 1974
- Late Cold War and Persian Gulf War Era, 1975 to 1991
- Post Cold War Era, 1992 to Present

The purposes, character, and extent of each of these development/use eras are summarized in the following five subsections. Additional details on the development and use of the range for military purposes are provided in Appendix B.

2.3.2.1 World War II Era (1941 to 1949)

The training emphasis throughout the range during World War II was on aerial gunnery. The eastern range area was used primarily for advanced aircrew training in fighter aircraft. This training included air-to-air gunnery, air-to-ground gunnery (i.e., strafing), and air combat flight maneuvers. Training in bombing ground targets was added to the curriculum in the later years of

[27] The BMGR has had a number of official and unofficial names in addition to the two referenced above. Some of these include "Ajo-Gila Bend Aerial Gunnery Range;" "Williams Bombing and Gunnery Range;" "Luke-Williams Bombing and Gunnery Range;" and, from 1963 to 1986, "Luke Air Force Range." Barry M. Goldwater Air Force Range became the official name of the range with the passage of the MLWA of 1986. This was shortened to Barry M. Goldwater Range and Barry M. Goldwater Range—East and Barry M. Goldwater Range—West became the designated names of the eastern (Air Force) and western (Marine Corps) components, respectively, with the passage of the MLWA of 1999.

the war. The western range area was also used to some extent for training fighter aircrews, but the principal instructional activity was in air-to-air gunnery training for bomber aircrews.

The level of development necessary to support training at the BMGR during the second World War was limited principally to three manned auxiliary air bases—at Gila Bend, Ajo, and Dateland—and 14 unmanned outlying auxiliary airfields. Personnel that either supported or participated in training were stationed at each of the three manned auxiliary air bases. Buildings were constructed at each of these bases to provide personnel housing and spaces for offices, workshops, aircraft hangars, classrooms, and storage, among other activities. The runways, taxiways, and parking ramps necessary for aircraft operations were also developed. The base at Gila Bend (now Gila Bend AFAF) is the only one of the three manned auxiliary air bases that remains inside of the BMGR and that continues to operate as a military installation. Student aircrews were sent to these auxiliary bases during World War II for concentrated periods of instruction in gunnery and possibly bombing training.

Available evidence indicates that the 14 outlying auxiliary airfields were day use only facilities at which personnel were not permanently stationed. Each of these 14 auxiliary airfields had three interconnecting, macadam-surfaced runways laid out as an equilateral triangle with an adjacent parking apron. No other permanent built-up infrastructure was present at these airfields. These airfields likely were used as locations to rotate aircrews and possibly to refuel or rearm aircraft between successive gunnery training missions. Eight out of the 14 auxiliary airfields remain within the BMGR; the other six are in locations that are no longer a part of the range. Three of the eight auxiliary fields that remain inside of the BMGR continue to be used for military purposes. The Marine Corps continues to use AUX-2, located at the far western end of BMGR—West, as a day use facility. Within BMGR—East, the auxiliary fields that continue to be used are Stoval Airfield, located southwest of Dateland near the northern BMGR boundary, and AUX-6, located within the Sentinel Plain and southwest of Gila Bend.

Luke AFB (then Luke Field) and Gila Bend AFAF were inactivated at the close of World War II. Ajo Army Airfield was deeded to Pima County in 1946 for use as a municipal airport. Control of the gunnery range passed to Williams AFB, which remained open. The extent to which the eastern side of the range continued to be used prior to the outbreak of the Korean War is not known. Yuma Army Air Base and Dateland Auxiliary Airfield were also inactivated at the close of World War II and the western side of the range apparently fell into disuse.

2.3.2.2 Korean War and Early Cold War Era (1950 to 1959)

The outbreak of the Korean War in 1950 rekindled the requirement to use the BMGR for aircrew training on a full-time basis. Full-time use of the range has continued unabated until the present.

Gila Bend AFAF and the eastern range area had fallen into disrepair during the inter-war years (1946-1950) and required substantial repairs and new construction. A suite of new target developments transformed BMGR—East from the predominantly aerial gunnery training facility that it had been during World War II into a complex that could support all phases of tactical air combat training. The new developments were designed to support instruction in both the employment of fighter aircraft weapons (guns, missiles, rockets, and bombs) and tactics in air combat. The changes at BMGR—East reflected lessons learned during World War II and the emerging demands of warfare in the jet aircraft age. Instruction in air-to-air gunnery continued to be an important range function, but the new era also brought training in air-to-air missile firing and a greatly expanded emphasis on the use of aircraft for air-to-ground attack. Development of the range to support these new training missions began in 1951 and the first phase of modernization was completed in 1954. By this time, BMGR-East was equipped with: (1) four ground controlled subranges; (2) five independently located vehicle convoy subranges; (3) a camouflage subrange; (4) a realistic tactical subrange; (5) an air-to-air firing subrange; and (6) a napalm (or fire-bomb) subrange.

One consequence of the expanded requirements to support training in air-to-ground attack was that development of the eastern range area included locations both around the perimeter and in the interior of BMGR—East. Previous development of this area of the range had been restricted principally to perimeter locations adjacent to U.S. Highway 80 and State Route 85, which provided easy access to the range for both development and use. The ground controlled subranges continued to be located along these highways to provide daily access for the ground crews who manned these facilities. The ground controlled subranges of this era were the forerunners in both function and location of the four manned ranges that are currently in use within BMGR—East. The development of the new tactical subrange, convoy subranges, and camouflage subrange required additional land and airspace in order to support the aircrew training activities that would occur at these locations. These new subranges were developed within interior locations of BMGR—East that later became North TAC Range, South TAC Range, and East TAC Range.

The primary use of the western range area from 1950 to 1951 was the support of an air-to-air gunnery and air-to-air rocket firing proficiency program of the U. S. Air Force Air Defense Command (ADC). This program was based at the Yuma Army Air Base (Vincent AFB after 1956). ADC was responsible for training and deploying the fighter interceptor squadrons that defended the United States against airborne attack. The range became the single location to which all ADC units deployed annually for proficiency training. The focus of the proficiency program from 1951 to 1954 was on air-to-air gunnery. From 1954 through 1958, the primary proficiency mission was switched from aerial gunnery to training with aircraft-launched air-to-air rockets. Interceptor launched air-to-air rockets were a new air defense weapon at the time. More than 60 interceptor squadrons participated in this training each year and launched tens of thousands of aerial rockets over the BMGR—West area. No new development of the BMGR—

West surface area is known to have been necessary to support the ADC proficiency training mission with the exception of an EOD area that was established south of AUX-2.

2.3.2.3 Middle Cold War and Vietnam War Era (1959 to 1974)

Air Force use of the BMGR—East area during the middle Cold War and Vietnam War era continued to focus on the training of aircrews to fly fighter and attack aircraft. The four basic types of subranges—tactical subranges, ground-controlled subranges, air-to-air gunnery subranges, and air-to-air maneuvering subranges—that had been established during the 1950s continued to provide the necessary training support, although the designs of the subranges were modified throughout this period to meet evolving training needs. By 1960, North, South, and East TAC ranges were well established in terms of the ground surface areas dedicated as ordnance impact locations. The types and layouts of targets within these three tactical ranges and the dimensions of the airspace reserved for the operation of each subrange would be modified in the future years, however, to meet new safety and training needs.

The training era began with six ground controlled subranges in operation within BMGR—East; but by the end of the period, the old ground controlled subranges had been inactivated and replaced with the four modern manned ranges in use today. Air-to-air gunnery occurred in two locations; a primary gunnery range was positioned within BMGR—East over the San Cristobal Valley and an alternate firing range was located over the Cabeza Prieta NWR. The primary gunnery range was also used for air-to-air missile firings.

The presence of the Marine Corps as a regular BMGR user began in 1959 when Vincent AFB was transferred to the Marine Corps and became Marine Corps Auxiliary Air Station Yuma (MCAS Yuma from 1962 forward). The interservice transfer of Vincent AFB was accompanied by a new joint-use agreement between the Air Force and Navy that granted Marine Corps use of the western area of the BMGR and its overlying restricted airspace. Marine Corps use of the western side of the range has continued ever since. The Air Force, however, retained control of and responsibility for the entire BMGR until control of BMGR—West was assigned to the Secretary of the Navy by the MLWA of 1999.

Marine Corps use of its new range stressed both air-to-air and air-to-ground air combat training. Air-to-air gunnery and air-to-air missile firing activities continued much as they had under the Air Force ADC. Two new target complexes, called Rakish Litter and Panel Stager, were constructed within the far-western part of the range to support the air-to-ground component of Marine Corps training. These complexes were similar to the Air Force ground controlled ranges in that they had bull's-eye type targets and range control personnel were present on the ground to direct the use of the subrange. These target complexes were used for aircrew training in the aircraft delivery of bombs, rockets, and gunfire. The munitions used on these target complexes were restricted to inert training ordnance, including bombs of up to 1,000 pounds in weight.

Other Marine Corps developments during the 1960s in the far western range area included a rifle range; machine-gun range; surface-to-air missile firing site; and a built-up training and administrative site, which was later called the Cannon Air Defense Complex. The rifle range and Cannon Air Defense Complex are still in use, but the machine-gun range and missile firing site have been inactivated.

Marine Corps ground use of the interior of BMGR—West east of the Gila and Tinajas Altas mountains was limited during this historical period to: (1) a fallout area for aerial gunnery and missile firing munitions and (2) electronic instrumentation sites. The aerial gunnery and missile firing subrange was in the southern half of the R-2301E airspace. The munitions-fallout area for this subrange included the western half of the Cabeza Prieta NWR and the southern half of BMGR—West. The electronic instrument sites included 10 remote tracking and telemetry test substations that form the electronic architecture of the TACTS Range that remains in current use. Nine of the 10 stations are located within BMGR—West; the tenth is located inside the Cabeza Prieta NWR.

2.3.2.4 Late Cold War and Persian Gulf War Era (1975 to 1991)

During the late Cold War and Persian Gulf War era, the eastern range area continued to be one of the principal Air Force training locations for student pilots transitioning to operational fighter and attack aircraft. BMGR—East was also important during this period for supporting the readiness training needs of operational Air Force, Air Force Reserve, and ANG units stationed in the local region and became increasingly important as a preferred site for readiness training deployments by units from locations where inclement winter weather curtailed flying activities. The important developments that occurred within BMGR—East during this period included: (1) construction of an electronic warfare (EW) range in 1975, (2) redevelopment of the target simulations in all three tactical ranges from 1975 through 1979, (3) expansion of tactical range EOD clearance activities from 1976 through 1977, (4) implementation of an MX missile test project in 1978, and (5) construction of an air combat maneuvering instrumentation (ACMI) range in 1979 and 1980.

Aircrews training on the EW range were challenged with electronic signals that simulated the frequencies of air defense radars—used to guide surface-to-air missiles and anti-aircraft artillery fire—and jamming systems. The EW range realistically simulated the types of air defense threats that aircrews could encounter in actual combat.

The tactical range redevelopment project was designed to bring the target scenarios within these subranges up to date with the types of conditions that aircrews could realistically encounter in combat. East TAC was redeveloped to simulate the probable look of a European theater of operations, North TAC as a Korean theater of operations, and South TAC as a Middle Eastern theater of operations.

The area subject to periodic EOD clearances within North, South, and East TAC ranges was greatly expanded beginning in 1975 to improve the safety conditions of the range. Prior to this time, manned ranges were cleared of expended munitions and scrap on a monthly and annual basis, but tactical ranges were cleared only as required for target repair and replacement. The EOD clearances on tactical ranges were limited to the paths needed to reach targets and the areas around targets in which the movement of vehicles and personnel was required to complete repair and replacement work, generally extending not more than 1,000 feet from the target (U.S. Air Force 1974). Targets within the tactical ranges were heavily contaminated with munitions as well as target scrap. The death of a civilian contractor and the injury of two other civilian workers who were torch-cutting scrap bombs near East TAC in 1975 drove the Air Force to consider range safety in a larger context. That condition coupled with range safety issues elsewhere in the Air Force led to a revised and expanded service-wide EOD program that established the current five-year EOD clearance criteria. The new criteria required that the ground surface of each target be cleared of expended munitions to a radius of one nautical mile (1.15 statute miles or 6,080 feet) or until the density of the munitions present was less than five intact items per acre. Each target had to be cleared under the new criteria at least once every five years. An annual requirement to clear surface exposed munitions out to a distance of 1,000 feet from the target was formalized at this time.

The new five-year EOD clearance program was applicable to both tactical and manned ranges and resulted in a dramatic increase in the acreage affected by this activity. In 1974, the total number of acres reported cleared of munitions for the four manned ranges and three tactical ranges combined was 27,575 acres, but, in 1976, 47,800 acres were cleared in South TAC alone (U.S. Air Force 1976; Stone 1977). In 1998, the Air Force reported that 152,895 acres of BMGR—East were affected by all EOD clearances (U.S. Air Force 1999). That figure included 118,042 acres for the three tactical ranges and 34,853 acres for the four manned ranges. The areas that are currently affected by annual and five-year EOD clearances within BMGR—East appear to have been fully established by the middle to late 1970s. Based on this timeframe for the initial five-year EOD clearances, each of the three tactical ranges had been subject to five or six five-year clearance cycles by 2000.

The MX Missile Buried Trench Construction and Test Project, which was part of a larger Air Force study program to develop a deployment mode for the MX Intercontinental Ballistic Missile (ICBM), was conducted immediately west of Stoval Airfield. The buried trench concept was to shuttle MX missiles in buried reinforced concrete tunnels to prevent the Soviet Union or any other adversary from knowing where to aim their missiles in a first strike attempt to eliminate an American retaliatory nuclear capability (U.S. Air Force 1978). The study on the BMGR was a proof of concept test with two purposes: (1) to test the ability of an apparatus to erect the missile through the top of the tunnel and overlying earth cover to prepare it for launch, and (2) to test the ability to shuttle the missile transport and launch vehicle through the tunnel. The total area disrupted by this project was 200 acres. The project is believed to have been active

from 1978 to 1980 and was reactivated briefly in 1986. The site was resealed following the completion of this test and has since remained inactive. No missiles were launched from this test site.

Although the BMGR's primary purpose and use are for military aircraft training, the range has also been reserved for use as a high-hazard testing area. The buried trench project and a companion MX missile test project that began in 1977 within BMGR—West are significant in that these projects are the only large-scale, surfaced-based test activities known to have occurred on the BMGR.

The ACMI system (now referred to as the GRMDS) was directly analogous to the Air Combat Maneuvering Range (ACMR) system constructed by the Navy and Marine Corps in 1972 within BMGR—West. Development of the ACMI Range involved the installation of three remote TIS stations at dispersed locations within BMGR—East and four subsystem stations at dispersed locations within the Cabeza Prieta NWR.

The primary training emphasis within the western range area during the late Cold War and Persian Gulf War era continued to be on readiness training for combat qualified Marine and Navy aviation units. Ground units with a direct or supporting role to play in the integration of Marine Corps air-ground combat teams were also incorporated in some exercises to both enhance the realism of the aviation training and provide realistic training for the ground component. In addition to this training, the western range area was also used by the Air Force Weapons Laboratory as a test location for evaluating underground shelter facilities designed to protect ICBMs. Ten surface use and development activities were identified as occurring within the western range area in support of these training and test operations. Two of these activities—Quarterly Battery Training, which began in 1975, and the WTI Course, which began in 1978—involved Marine ground unit use of selected range surface. Three of the activities were sequential steps in the series of tests conducted by the Air Force Weapons Laboratory from 1977 to 1985. One activity involved an upgrade to the Rakish Litter and Panel Stager target complexes in the late 1970s and a second activity, in 1986, included the inactivation of these complexes and the simultaneous construction of the Moving Sands and Cactus West target complexes as replacements. Development of new ACMR facilities, in 1982 and 1986, comprised two of the three remaining activities. The tenth activity was the 1987 construction of a landing and take-off practice area at AUX-2 that simulated the flight deck of a U.S. Navy LHA ship.

Quarterly Battery Training involved the deployment of a HAWK anti-aircraft missile unit to the western half of the range for a three- to five-day training exercise. This activity required the movement of the unit's personnel, vehicles, and equipment to one or more locations on the range that were considered to be tactically favorable for their mission. No missiles were carried during this exercise, but the unit would employ air defense radars in simulated engagements with aircraft training in R-2301W. Quarterly Battery Training was important in the military surface

use history of the BMGR for two reasons. First, it was one of the earliest ground-unit training uses of the range and, second, it appears to have been the first that required the unit to have the option to use a number of different range locations (now called ground support areas) during an exercise in order to provide realistic training. The average area occupied by a ground unit at any one location was several hundred meters on a side.

Use of the BMGR as a training site for the semiannual WTI Course began in 1978. Like Quarterly Battery Training, this activity also required that ground units have a number of surface locations to which they could deploy available within the range. Similar to the experience of Quarterly Battery Training, a number of specific range locations emerged after several WTI Courses as having the best tactical characteristics to support the missions of the various ground units. In the years following the inception of Quarterly Battery Training and WTI Course use of the range, the surface locations used to support these two training exercises were also used for other ground-based training activities. Marine Corps units that routinely participated in the WTI Course used the same surface locations for additional training activities specific to the unit.

An inventory of the ground support areas needed to provide the flexibility required for the various Marine Corps ground-based training exercises was completed in 1988. At that time, the inventory found that 41 individual ground support areas were in periodic use. The 41 areas included AUX-2, Stoval Airfield, the 35 undeveloped ground support areas that remain actively used, and four undeveloped ground support areas that have since been retired. Most sites were one square kilometer (0.386 square miles) or less in size but a few multiple-unit sites were larger. The aggregate area available in the 41 ground support areas was 19.0 square miles (49.2 square kilometers). This same inventory of sites constitutes the ground support areas that currently are approved for Marine Corps ground unit use of the BMGR.

The first large-scale, surfaced-based test project known to have occurred on the BMGR was initiated in April 1977 within BMGR—West at a location about 12 miles south of Wellton, Arizona. This project was the first of a series of tests that was part of the larger Air Force study program to develop workable basing modes for the MX ICBM. The BMGR—West projects evaluated the potential for two protective shelter designs, a hardened underground missile silo and a buried hardened tunnel through which a missile would be shuttled, to survive the effects of a nuclear weapon attack. The program involved exposing subscaled prototypes of the proposed shelters to blast and shock pressures generated by conventional high explosives in an increasingly powerful series of separate detonation tests calculated to simulate the effects of a nuclear weapon attack. The validity of the tunnel-basing mode was further tested within the eastern range area beginning in 1978. The BMGR—West test series, which culminated in 1985, resulted in the clearance or excavation of 650 to 700 acres in several irregularly shaped but closely located parcels. All of the aboveground infrastructure and debris from this series of projects was removed from the site except for two large bunkers, one which the Marine Corps now uses as a storage facility.

In the early 1980s, the Rakish Litter and Panel Stager target complexes were both equipped with a WISS. This scoring system used closed-circuit television cameras, operated remotely by personnel at MCAS Yuma, to measure the impact position of air-to-ground weapons with respect to referenced positions within these complexes. The WISS eliminated the need to station personnel at the Rakish Litter and Panel Stager complexes to measure the accuracy of munition impacts.

In 1986, the Rakish Litter and Panel Stager target complexes were inactivated and replaced with two new target complexes constructed within BMGR—West. The locations of the Rakish Litter and Panel Stager target complexes had required aircraft to overfly off-range residential areas that had been developed since these target complexes were built in the 1960s. The two new complexes, called Moving Sands and Cactus West, were located southeast of AUX-2 in positions that eliminated the need for aircraft to overfly noise sensitive off-range areas. Each of these new target complexes consisted of one air-to-ground rocket and bomb bull's-eye target with a 59,200-foot-long northwest-southeast oriented run-in line, two strafing targets, and one MLT. Munition deliveries on the bull's-eye targets were scored by a WISS. Ordnance use within the Moving Sands and Cactus West complexes was restricted to inert practice ordnance of up to 1,000 pounds in weight.

The upgrades to the ACMR (now called tactical aircrew combat training system or TACTS) in 1982 and again in 1986 added an air-to-ground weapons delivery training component (called no-drop weapon training system) to the TACTS that permitted instruction in air-to-ground weapons use without the use of actual munitions. The new facilities included target simulations and the electronic instruments needed to simulate munitions deliveries. The performance of aircrews in attacking the ground-based targets was calculated and recorded for a later replay by the TACTS.

The LHA deck was constructed on the existing east-west runway of the World War II era AUX-2 airfield. The purpose of the LHA deck was to provide a location for helicopter and AV-8B aircraft aircrews to practice landings, takeoffs, and shipboard aircraft handling procedures prior to their deployment to an actual LHA ship. Aircrews flying the C-130 tactical airlift aircraft also began using AUX-2, during the late 1980s, as a site for readiness training in operating out of unimproved airfields. Landing and takeoff operations are conducted on the northeast-southwest oriented runway of the old auxiliary airfield.

2.3.2.5 Post Cold War Era (1992 to Present)

The downsizing that the U.S. military has experienced since the end of the Cold War in 1989 and the Persian Gulf War in 1991 has had the effect of eliminating some training missions on the BMGR and reducing the importance of others. At the same time, some new facilities have been constructed and new training activities have been implemented. In terms of changes in military land use, however, the last decade has been relatively quiet compared to the first five decades of

range development. Notable changes within BMGR—East since 1991 have included construction of four RMCPs, a sharp decline in the training requirement for live-fire air-to-air gunnery, and inactivation of the munitions treatment range. Changes within BMGR—West have included installation of radar threat emitters, construction of the Moving Sands Complex urban target, designation of the TACTS Range laser hazard area, expansion of the ground support areas, reductions in ground unit training activities, and elimination of the HAWK Firing Exercise (FIREX) mission.

Prior to 1993, munitions residue that had been recovered through EOD processes was cleared from the manned and tactical range targets and buried in pits dug in designated areas of these ranges and marked with signs. A 1997 field inventory identified 30 munitions burial areas within BMGR—East (U.S. Air Force 1997a). Beginning in 1993, this practice was no longer permissible under new environmental requirements. A munitions demilitarization, decontamination, and recycling process had to be implemented under the new requirements before munitions residue could be disposed. Four RMCPs were established within BMGR—East adjacent to the manned and tactical ranges (see Figure 2-1) to provide locations to which munitions residue cleared from the training ranges could be transported, secured, and processed for final disposal (see Appendix B).

Live-fire instruction in air-to-air gunnery was a staple of aircrew training within BMGR—East from World War II through the early 1990s. Changes in training requirements implemented following the Persian Gulf War, however, reduced live-fire air-to-air gunnery activity within BMGR—East to a minimal level. By 1992, a change in the F-16 training syllabus eliminated live-fire air-to-air gunnery as a requirement for aircrews to qualify in this aircraft. Gunnery remains as a factor in air-to-air combat, but the Air Force has found that initial aircrew qualification training in the F-16 can be completed satisfactorily based on simulated aerial gunnery experience gained on the GRMDS alone. A requirement for this training remained in effect, however, for the ANG and the 162nd FW continues to conduct several dozen live-fire air-to-air gunnery missions annually in the F-16. This number of sorties stands in sharp contrast to the several hundreds of gunnery missions that were flown prior to the Persian Gulf War. The reduction in air-to-air gunnery training requirements was reflected in a 1994 MOU between DoD and the Department of the Interior (DOI) that placed the Alternate Air-to-Air Firing Range overlying the Cabeza Prieta NWR into an inactive status.

The early 1990s also brought another important change related to air-to-air gunnery training within BMGR—East. From 1956 until 1993, a rigid DART was used as an aerial gunnery training target. The DART was towed behind one aircraft on a 1,500-foot-long cable and fired upon by another aircraft. Several thousands of DARTs are estimated to have been expended over BMGR—East and the Cabeza Prieta NWR over the course of 37 years of their use as a result of cannon fire that severed the tow cable or that damaged the aerodynamics of the DART requiring that it be jettisoned. The AGTS tow target replaced DARTs as aerial gunnery targets in 1994. The AGTS consists of a fabric banner, about 12 feet long, that is reeled out and in on a

cable from a pod attached under the wing of the tow aircraft. Gunnery hits on the AGTS are acoustically scored in flight. AGTS may be expended as a result of hits on the tow cable but these tow targets are not subject to aerodynamic instability.

A RCRA-permitted munitions treatment range, located north of Manned Range 2 near the Manned Range 4 access road (see Figure 2-1), that was approved for the disposal of munitions with expended shelf or service lives through open burning or open detonation was inactivated in 1996. A portion of this range presently remains active only as an EOD detonation training facility. The net explosive weight limit for a single training explosion is 2,000 pounds of high explosives.

Sites for the use of mobile radar threat emitters were first developed within BMGR—West in 1985 to provide aircrews with the challenge of flying in a combat environment with sophisticated and dangerous air defenses. The first permanent fixed emitter was installed on the range in 1995 at a site on the northeastern side of the Copper Mountains. Seven additional fixed site emitters were installed in 1997 and 1998 to bring the number of these types of emitters to the current total of eight.

Conversion of the Moving Sands conventional bull's-eye target as a simulated urban complex occurred during this same period. This urban target complex was developed after combat experiences in the Persian Gulf War and Somolia had demonstrated the difficulty of identifying, designating, and attacking targets in an urban setting without damaging or destroying nearby civilian populations or property.

The laser hazard area overlying the TACTS Range main airfield target complex was established in 1999 as a part of the TACTS Range upgrades that included development of the fixed site threat emitters during the same period. The laser hazard area supports training with airborne lasers used to designate targets within the main airfield complex selected for simulated attack within the TACTS Range no-ordnance-release scoring system.

Following the Persian Gulf War, the Marine Corps anticipated a need for additional ground support areas within BMGR—West for ground unit training deployments during the WTI Course or other times. At that time, the ground support system consisted of 41 individual ground support areas that collectively comprised 19.6 square miles. Following an environmental planning and review process documented in the Yuma Training Range Complex EIS (U.S. Marine Corps 1997), the Marine Corps approved expanding the ground support system by 16.5 square miles. This included incorporating 19 existing support areas and other lands into three consolidated ground support zones, retaining 16 existing ground support areas and AUX-2 outside of the zones, adding five new ground support areas, and inactivating four other existing support areas. Downsizing of the Marine Corps, however, ultimately reduced the number of ground unit squadrons available to participate in the WTI Course because of competing operational deployments and readiness requirements. As a result, the expanded ground support

areas and zones approved for ground unit use have not yet been activated for training activities. At the same time, advancements in electronics so reduced the sizes of new generation radar and communications equipment that the numbers of personnel and vehicles required by some types of Marine Corps ground units was in turn significantly reduced. As a result, the size of the surface use footprints of these units during BMGR training deployments also decreased.

Finally, the HAWK antiaircraft missile was retired from the Marine Corps inventory after 1998 leading directly to the inactivation of the air defense units that had employed this weapon system. HAWK missile units were a major component of the ground troop presence on the BMGR during WTI Courses and their inactivation has correspondingly reduced the need for ground support locations during these training events. The newly approved ground support locations remain available for use, however, should future training missions require their activation or if environmental management problems at a currently active site require that training activities be relocated.

The elimination of HAWK missile units and, by default, the HAWK FIREX had the additional effect of at least temporarily placing the surface-to-air missile firing range within BMGR—West into an inactive status. The firing range remains available, however, to support missions requiring the launch of other types of surface-to-air missiles.

2.3.3 Natural and Cultural Resource Management History of the BMGR

The natural and cultural resources management history of the BMGR has been somewhat unique in contrast to that of most federal public land. Over the course of at least the last half-century, most federal lands—such as those under the jurisdiction of the U.S. Forest Service, NPS, BLM, or USFWS—have been managed by a single federal agency for which resource management is the primary mission. As a result, clear purposes and patterns of management have developed based on the agency's mission, regulations, past management plans and practices, past and current land uses, resource conditions, and public involvement.

Management of the BMGR has differed from this typical model in several important ways. First, primary management responsibility for the range has undergone several jurisdictional switches between DoD and DOI agencies with the result that a long-term, comprehensive, resource management program has not yet been fully put in place. The first comprehensive natural resources management plan for the range was not prepared until 1986, and a land management plan was not implemented for the range until 1990. Second, for at least the first four decades after the creation of the BMGR, there were no clear DoD or DOI resource management priorities specific for the range. Third, through much of the history of the range, the lack of a central federal authority for resources management led to actions by a number of agencies, at the federal and state levels, that occurred without the development of mutually held goals or coordination of purpose. Fourth, at many points in the range's history these same agencies have found

themselves with competing or conflicting responsibilities, goals, and purposes without an effective means of resolving these issues and coordinating their management efforts. Much progress has been made in recent years toward resolving these issues. The following review will identify the management legacy that has been developed for the range and the progress that his been made towards establishing effective control and coordination of range management.

Primary federal surface management responsibility for the lands currently within the BMGR has changed five times since 1941. The five land jurisdiction periods applicable to the range include:

- Prior to September 1941—General Land Office and U.S. Grazing Service (these two agencies were merged in 1946 to form the BLM)
- September 1941 to December 1958—Air Force, full responsibility for entire range
- January 1959 to November 1986—Air Force, administration of the entire range and military operations management of BMGR—East; Navy/Marine Corps, military operations management of BMGR—West
- November 1986 (MLWA of 1986) to 6 November 2001—Air Force, military administration of the entire range and military operations management of BMGR—East; Navy/Marine Corps, military operations management of BMGR—West; BLM, land management for entire range
- 6 November 2001 (MLWA of 1999) to 6 November 2024—Air Force, full responsibility for military operations and land management of BMGR—East; Navy/Marine Corps, full responsibility for military operations and land management of BMGR—West

Prior to the withdrawal and reservation of the first 1.1-million-acre parcel of the range in September 1941, most of the federal lands currently within the BMGR were under the jurisdictions of the General Land Office and the U.S. Grazing Service, which administered livestock grazing permits. Some mining and livestock grazing activities are known to have occurred within the future military reservation lands, but there were no specific natural resource management programs in place other than the administration of mining claims and grazing permits.

The establishment of the military range in 1941 transferred the authority to control access to and use of the affected properties to the War Department (DoD after 1947). This transfer of jurisdiction did nothing to foster development of natural or cultural resources management programs for the affected lands, but the action did have the effect of suspending and eventually ending sanctioned mining and livestock grazing activities within the range properties. The new range lands were withdrawn from all forms of appropriation under the public land laws. This withdrawal was not because appropriative land uses (such as mining and livestock grazing) were regarded at the time as inappropriate resource uses, but because these uses were incompatible with the basic purpose of the military reservation. That purpose was to provide a location where military aircrews could perform live-fire training with aircraft weapons without either endangering public safety or incurring disruptive interference from the need to protect private property or access to that property.

From the perspective of resource conservation, the effect of excluding appropriative land uses from the range would arrest further commercial development or settlement of the range properties. This resulted in the unplanned but nevertheless beneficial effect of protecting many areas of the range from further disturbance. Creation of the military range did not cause mining and livestock grazing activities to be ended immediately. A number of court and enforcement actions were necessary both when the BMGR was created and at several times during its first several decades of existence to eliminate recurring incidences of trespass livestock grazing from various portions of the military range. However, the important consequence of these actions for future resources management is that the BMGR today, coupled with the Cabeza Prieta NWR and Organ Pipe Cactus NM, is the most expansive, least grazed, and least developed area of the Sonoran Desert.

The Air Force exercised primary surface management and military operations control for the entire range from 1941 to 1958. In 1959, the Air Force delegated local management and operations control for the BMGR—West area to the Navy/Marine Corps, but retained administrative oversight authority for the entire range. The Air Force and Navy/Marine Corps retained primary surface management control of the range until the passage of the MLWA of 1986. With the exceptions of selected wildlife management activities, a series of inter-agency agreements, and environmental compliance efforts for proposed federal projects (after 1970), the period from 1941 to 1982 was generally characterized by little government or public attention to developing broader resource management programs for the BMGR. These early activities, however, were important for establishing management foundations that are important to the development of the proposed INRMP.

Specific wildlife management activities within the range area presumably began with AGFD enforcement of State hunting regulations and other wildlife laws before the military reservation was established. Perhaps the most notable early action on this score was the prohibition on hunting Sonoran pronghorn that was put in place in 1922, 45 years before this species was federally listed as endangered. Wildlife habitat and population reconnaissance surveys were conducted early in the range area by AGFD in support of its hunting management responsibilities. Wildlife surveys have continued to be a cornerstone management activity on the BMGR and now often involve the collaborative efforts of all of the BEC members. The earliest evidence of Air Force involvement in wildlife management activities identified during the preparation of this EIS occurred in the Fall of 1962 when the Air Force provided helicopter support for aerial bighorn sheep population surveys (U.S. Air Force 1962). The development and maintenance of game waters for wildlife enhancement, particularly for the benefit of bighorn sheep, began at least as early as the 1940s through the efforts of AGFD and the USFWS. Wildlife water development has continued to be an important wildlife management activity and issue.

The aforementioned series of inter-agency agreements, which began as early as 1951, are historically important because they demonstrate (1) recognition of the relationships between some military activities and resource management issues, (2) recognition of individual agency authorities and responsibilities, and (3) continuing efforts to facilitate effective inter-agency resource management cooperation. The earliest agreement in this series was developed in August 1951 between the DOI and DoD. This agreement, and four successor agreements in 1960, 1975, 1991, and 1994, established restrictions on military overflights and surface use of the Cabeza Prieta NWR. Prior to the MLWA of 1999, more than 95 percent of the refuge was also included within the military reservation. As a result of these agreements, military overflights of the refuge have been restricted to altitudes of 1,500 feet above ground level (AGL) or higher except within low-level overflight corridors mutually approved by the DOI and DoD, World War II authorization for military bombing practice within the refuge has been eliminated, procedures have been set in place for responding to aircraft crashes within the refuge, and military surface use of the refuge has been restricted to mutually approved locations and activities.

Aside from the early agreements pertaining to the Cabeza Prieta NWR, a 1978 MOU between the Air Force, Navy/Marine Corps, and Arizona Game and Fish Commission is particularly notable as a prelude to an agreement that would lead to the first comprehensive natural resources management plan for the BMGR. The 1978 MOU recognizes that the responsibility for the conservation and control of wildlife and other wildlife resources and for regulating hunting rights rests with the State, and that the protection and conservation of wildlife and wildlife resources must be consistent with the requirements of the military purposes of the BMGR. This inter-agency agreement was important because it represented the earliest formal recognition of the relative responsibilities of the Air Force, Navy/Marine Corps, and AGFD for wildlife management on the BMGR as established by the Sikes Act and reserved State's rights. This inter-agency agreement also provided a formal basis for cooperative action as demonstrated that same year through a cooperative plan agreement among the same parties for the conservation, development, and management of wildlife resources.

Following the 1978 agreement was the much more broadly defined 1982 natural resources management cooperative agreement between the Air Force, Navy/Marine Corps, USFWS, BLM, and AGFD. This agreement acknowledged and defined the relative roles and responsibilities of each of these agencies for the cooperative management of natural resources on the BMGR. This landmark agreement is important for two key reasons. First, this agreement marked the first time that the five agencies, that were to form the BEC in 1997, acknowledged that they each have constructive resource management roles to play and that effective management of the natural resources of the range depended upon their collective and cooperative efforts. Second, the 1982 agreement called for the development of the first range-wide natural resources management plan for the range. The Air Force was assigned as the lead agency for the development of the plan and, with contracted support from the University of Arizona and cooperative participation from the other members of the 1982 agreement, produced the Luke Air Force Range Natural Resources Management Plan in 1986 (U.S. Air Force 1986). This plan was the first

comprehensive management plan developed for the range and, as such, advanced resource management perspectives and expectations. The 1986 plan demonstrated the importance of:

- establishing an overall management vision for the range and long-term management goals for each natural and cultural resource element
- addressing a broad rather than narrow scope of natural and cultural resource elements in a single plan in order to promote integrated management
- identifying the land and airspace use requirements of the military mission and acknowledging those requirements as baseline conditions with which resource management must be consistent
- adapting management strategies to promote resource protection and conservation opportunities that are created by military use requirements
- identifying and supporting the collective management responsibilities and interests of the multiple federal and state agencies involved with the range in order to promote inter-agency communication and cooperation
- recognizing that future resource management success would require an ongoing inter-agency framework to foster open communication and cooperation on BMGR resource management issues

In many respects, the 1986 resources management plan reflects requirements for INRMPs that have since been either set in place or reinforced by the MLWA of 1999, Sikes Act Improvement Amendment of 1997, and DoD policy. In 1986, however, Congress determined (through the MLWA of 1986) that the DOI rather than the DoD would have the lead responsibility for managing the lands of the BMGR and the 1986 resources management plan was not implemented. Instead, that plan became the basis from which the BLM developed the Goldwater Amendment in accordance with the MLWA of 1986 and the FLPMA to provide guidance for managing the natural and cultural resources of the BMGR. The Goldwater Amendment adopted many of the goals of the 1986 plan, including the protection of plant communities, wildlife habitats, and species diversity.

The Air Force and Navy/Marine Corps retained primary surface management control of the range until the MLWA of 1986 signaled the beginning of the fourth change in federal land jurisdiction for the BMGR. That Act signified the primacy of the military purposes of the range over all other land uses and left the military agencies with the authority to control access to and use of the properties within the range to the extent necessary to support those purposes. The Secretary of the Interior, however, was assigned the responsibility for managing the range lands. This shared management situation persisted under the MLWA of 1986 until Congress transferred the primary federal land surface management responsibility to the Secretaries of the Air Force and Navy as provided by the MLWA of 1999.

Although management under the terms of the MLWA of 1986 has been controversial at times, a number of positive management accomplishments occurred under the tenure of this Act. One of

the earliest and most important accomplishments was the public involvement process that the BLM conducted during the development of the Goldwater Amendment. Development of this plan marked the first time that the public was given an opportunity to have input as to the future management and public use of the BMGR. This process allowed members of the public to become better informed about range management issues, identify issues about which they were concerned, and provide comment about the resolution of those issues.

An ongoing public involvement process was not established following the completion of the Goldwater Amendment in 1990 and steps were not taken to establish regular, clear channels of communication among the five signatory agencies of the former 1982 natural resources management cooperative agreement. Public concerns were nevertheless registered about the perceived questionable quality of BMGR management and in 1996 the BLM, Air Force, Marine Corps, USFWS, and AGFD initiated a series of ongoing public involvement partnership meetings to openly discuss range management issues. These BMGR partnership meetings also provided a forum by which the five management agencies could renew the practice of holding periodic management consultation and coordination meetings that had occurred in the 1980s after being initiated by the 1982 cooperative agreement. The success of these renewed inter-agency contacts led the same five agencies to develop the BEC as an informal committee in 1997 and as an official entity in 1998. Congress recognized the success of the BMGR partnership meetings and the BEC and mandated, through the MLWA of 1999, the formation of an Intergovernmental Executive Committee. This committee is to consist of selected representatives from interested federal agencies as well as from state, local, and tribal governments for the purpose of exchanging views, information, and advice relating to the management of natural and cultural resources on the BMGR.

Another important accomplishment of the Goldwater Amendment was recognition of the need to provide special management protections to some locations of the BMGR that have sensitive resource values. In this capacity, the Goldwater Amendment built upon a resource protection legacy initiated on the range and elsewhere in Arizona by Arizona State Parks through a 1980 survey of candidate locations for State Natural Area designation. Five State Natural Areas were designated on the range in 1982 through cooperative agreements between the State Parks Board, Air Force, and Marine Corps. The BLM, in turn, designated three of the State Natural Areas as ACECs and two as Special Recreation Management Areas (SRMAs) through the development of the Goldwater Amendment. A Backcountry Byway centered on the western segments of El Camino del Diablo was also designated. As the focus of BMGR management has shifted to the development of this EIS for the proposed INRMP, future management of the existing ACECs, SRMAs, Backcountry Byway, and possibly other candidate natural areas is once again one of the leading management issues.

2.4 DOD LAND MANAGEMENT POLICY GUIDANCE APPLICABLE TO THE PROPOSED INRMP

2.4.1 Land Use Versus Land Management

Understanding the distinct differences between land use and land management is fundamentally important to the context under which the proposed INRMP must be developed. For federal agencies, land use is defined as the purposes for which land is used to support an agency's mission. Land management is defined as the activity pursued to support continuation of the agency's land use. The land managing agencies of the Departments of Agriculture and the Interior (e.g. Forest Service, USFWS, NPS, and BLM) have land uses that are intrinsically based on natural and cultural resources management. The varying missions of these agencies are to manage land for multiple uses, fish and wildlife purposes, or protection of sensitive resources for the benefit and enjoyment of visitors. As a result, land use and land management for these agencies are deeply intertwined. Indeed, resource management plans prepared by these agencies often examine alternative mixes of land use for the properties under their jurisdictions as well as alternative methods of managing those uses. In essence, agencies of the Departments of Agriculture and the Interior are defined in large part by their land management missions.

The mission of the Armed Forces, however, is national defense. The use of land by defense agencies is grounded in the need to use land for defense mission purposes rather than for the management of land for its own sake. This is why it is important that land use and land management be understood as separate concepts. Defense agencies must manage land first and foremost so that land uses necessary to support military missions can continue while simultaneously ensuring compliance with the suite of laws governing protection of natural and cultural resources. In turn, compliance with environmental and cultural resource laws is necessary to accomplish the military mission.

The Sikes Act addresses the issue of land use versus land management by directing that DoD land management must be "consistent with the use of military installations to ensure the preparedness of the Armed Forces" [16 U.S.C. 670a (a)(3)]. In other words, the BMGR must be used to support National defense purposes and each natural or cultural resource management goal or course of action set forth in the proposed INRMP must be consistent with those purposes. This means that resource management alternatives designed to protect, conserve, or rehabilitate natural or cultural resources must also be capable of supporting and sustaining the military mission.

However, proposed natural or cultural resource management practices can directly support military mission requirements. Some practices, such as dust suppression on roads or measures to comply with environmental laws such as the ESA or NHPA, may be designed and implemented

directly in support of specific mission requirements. Other management practices, though, may support the military mission indirectly by furthering the biological health of the range or the security of its cultural resources. These actions could help to prevent unnecessary conflicts between military operations and resource protection requirements and, as a result, lend support to the continuing use of the BMGR for military purposes. The history of the BMGR includes many examples of management practices that are mutually compatible and beneficial to sustaining both military operations and resource conservation values and public use opportunities. The alternative management scenarios being assessed in this EIS for the proposed INRMP are specifically designed to consider natural and cultural resource management approaches that can both support military mission requirements and benefit land conservation and sustainable public use goals.

2.4.2 Legal Requirements Guidance

Consistent and compatible with the straightforward military mission support requirement, the MLWA of 1999 and Sikes Act also require the INRMP to facilitate a management program that: (1) protects and conserves the natural and cultural resources of the BMGR, and (2) provides for public access and sustainable use of those resources. Other specific requirements, as summarized in Table 2-2, include providing for wildlife and land management, wildlife-oriented recreation, wildlife habitat enhancement or modification, and wetland conservation (including protection, enhancement, or restoration); supporting Native American access to sacred sites; and requiring that gates, fences, or other barriers constructed in the future allow for wildlife access.

TABLE 2-2
INRMP ELEMENTS SPECIFIED IN THE
SIKES ACT IMPROVEMENT AMENDMENTS AND MLWA OF 1999

Sikes Act Improvement Amendments
To the extent appropriate and applicable, provide for: · wildlife management, land management, and wildlife-oriented recreation · wildlife habitat enhancement or modifications · wetland protection, enhancement, and restoration, where necessary for support of wildlife or plants · integration of, and consistency among, the various activities conducted under the plan · establishment of specific natural resources goals and objectives and time frames for proposed actions · sustainable use by the public of natural resources to the extent that the use is not inconsistent with the needs of wildlife resources · appropriate public access subject to requirements necessary to ensure safety and military security · enforcement of applicable natural resource laws (including regulations) · no net loss in the capability of military installation lands to support the military mission of the BMGR

TABLE 2-2
INRMP ELEMENTS SPECIFIED IN THE
SIKES ACT IMPROVEMENT AMENDMENTS AND MLWA OF 1999

MLWA of 1999
The INRMP shall: · be developed in consultation with affected Indian tribes and include provisions that address (1) meeting the trust responsibilities of the United States with respect to Indian tribes, lands, and rights reserved by treaty or federal law; (2) allowing access to and ceremonial use of sacred sites to the extent consistent with the military purposes of the BMGR; and (3) providing for timely consultation with affected Indian tribes · provide that any hunting on the BMGR be conducted in accordance with the provisions of 10 U.S.C. 2671 (the general military policy for hunting, fishing, and trapping on military reservations) · identify current BMGR test and target impact areas and related buffer or safety zones · provide necessary actions to prevent, suppress, and manage brush and range fires occurring within the BMGR as well as brush and range fires occurring outside of the BMGR resulting from military activities · provide that all gates, fences, and barriers constructed on the BMGR are designed and erected to allow wildlife access, to the extent practicable and consistent with military security, safety, and sound wildlife management use · incorporate any existing management plans pertaining to the BMGR, to the extent that INRMP preparers mutually determine that incorporation of such plans into the INRMP is appropriate · include procedures to ensure that the periodic reviews of the plan under the Sikes Act are conducted jointly by the Secretaries of the Navy, Air Force, and Interior, and that affected States, Indian tribes, and the public, are provided a meaningful opportunity to comment upon any substantial revisions to the plan that may be proposed · provide procedures to amend the plan as necessary

2.4.3 DoD Ecosystem Management and Biodiversity Policy Guidance

DoD has shifted its land management focus over the last 10 years or so from protection of individual species to ecosystem management. The two principal reasons for this shift are (1) the Sikes Act emphasizes promoting effective wildlife and habitat protection, conservation, and management, and (2) there is a concern that a disproportionate amount of attention in the past has been placed on managing the needs of individual high-profile species in possible conflict with underlying ecosystem functions. Current DoD policy to display environmental security leadership within DoD operations, activities, and installations worldwide is set forth in DoD Directive 4715.1, *Environmental Security.* Under this directive, DoD Instruction 4715.3, *Environmental Conservation Program*, outlines policy, assigns responsibilities, and prescribes procedures for the integrated management of natural and cultural resources on property under DoD control. This instruction calls for INRMPs to be based, to the maximum extent practicable,

on ecosystem management. The goal of DoD ecosystem management is to maintain and improve the sustainability and native biological diversity of ecosystems while supporting human needs, including the DoD mission. This goal is reflected in the Department level land management policies of the Air Force and Marine Corps. Consequently, ecosystem management and protection of biological diversity must be important guiding elements of the proposed INRMP.

DoD policy guidelines on ecosystem management are intent on promoting/protecting natural processes but do not preclude active management intervention deemed necessary to deal with issues such as invasive species, endangered species recovery, or barriers to wildlife movement inside or outside of the installation. DoD expects its resource managers to use the best available science, collaborative efforts with federal and state wildlife agencies, and consultations with outside experts and the public in reaching management decisions. If that science together with collaborative efforts and consultations identify a need for management intervention, then the needed management actions are to be implemented.

2.4.4 Department of Interior Oversight Requirements

The MLWA of 1999 assigns important BMGR oversight management functions to the Secretary of the Interior. Chief among these is the responsibility set forth via an authority for transfer of management responsibility from the Navy/Marine Corps or Air Force to the DOI if the Secretary of the Interior determines that (1) the Navy/Marine Corps or Air Force has failed to manage BMGR natural and cultural resources in accordance with the proposed INRMP and (2) this failure is resulting in significant and verifiable degradation of the natural or cultural resources of the BMGR. Thus, the Secretary of Interior has been granted considerable power as an official watchdog over the military's management of BMGR natural and cultural resources.

If the Secretary of the Interior determines that the Navy/Marine Corps or Air Force failure to manage is resulting in significant and verifiable degradation of BMGR natural or cultural resources, the process for the transfer of management responsibility is outlined in the MLWA as follows:

(1) The Secretary of the Interior must give the Secretary of the Navy or Air Force, as the case may be, written notice of such determination, a description of the deficiencies in management practices, and an explanation of the methodology employed in reaching the determination.

(2) Within 60 days of the notification, the Secretary of the Navy or the Secretary of the Air Force, as the case may be, shall submit a response to the Secretary of the Interior, which may include a plan of action for addressing any deficiencies identified in the notice in the conduct

of management responsibility and for preventing further significant degradation of BMGR natural or cultural resources.

(3) If, three months after notification, the Secretary of the Interior determines that deficiencies identified in the notice are not being corrected and that significant and verifiable degradation of BMGR natural or cultural resources is continuing, the Secretary of the Interior may submit a notice and a report to the Committees on Environment and Public Works, Energy and Natural Resources, and Armed Services of the Senate and the Committees on Resources and Armed Services of the House of Representatives.

(4) Not earlier than 90 days after the Secretary of the Interior submits the notice and report to the aforementioned congressional committees, the Secretary of the Interior may transfer management responsibility for BMGR natural and cultural resources from the Secretary of the Navy or the Secretary of the Air Force, as the case may be, to the Secretary of the Interior in accordance with a schedule for such transfer established by the Secretary of the Interior.

After such a transfer of management responsibility, the Secretary of the Interior may transfer management responsibility back to the Secretary of the Navy or the Secretary of the Air Force if the Secretary of the Interior determines that procedures and plans have been established to ensure that the lands concerned will be adequately managed by the Secretary of the Navy or the Secretary of the Air Force, as the case may be, in accordance with the proposed INRMP.

Another oversight responsibility assigned to the DOI is a requirement for the Navy/Marine Corps and the Air Force to consult with the DOI before using the BMGR for any purpose other than the purposes for which it was withdrawn and reserved.

2.5 NON-MILITARY AGENCY MISSIONS AND LAND USE

As detailed in Section 1.2, in addition to the Air Force and Marine Corps, various federal and state non-military agencies have management responsibilities on the BMGR. Two such non-military agencies with missions that have and will continue to require future operations on the BMGR are the AGFD and the U. S. Border Patrol, whose primary objectives include wildlife management and law enforcement, respectively. Thus, a brief summary of the agency missions and land uses on the BMGR associated with these missions is presented to provide further context with regard to the need for the INRMP to be developed on a collaborative interagency basis.

2.5.1 Arizona Game and Fish Department

The AGFD has management authority of the state's wildlife, which is held in trust for the citizens of the State of Arizona; this wildlife management responsibility also applies to the BMGR unless otherwise pre-empted by federal law. Established in 1929 under Title 17 of the Arizona revised statutes, AGFD is directed by the Arizona Game and Fish Commission, the governing body of the department. Under the provisions of Arizona Revised Statutes 17-231, the Arizona Game and Fish Commission establishes policy for the management, preservation, and harvest of wildlife. Under the umbrella of the Commission, the AGFD's mission is as follows:

> To conserve, enhance, and restore Arizona's diverse wildlife resources and habitats through aggressive protection and management programs, and to provide wildlife resources and safe watercraft and off-highway vehicle recreation for the enjoyment, appreciation, and use by present and future generations.

The primary wildlife management responsibilities of AGFD on the BMGR include:

1. Enforce hunting regulations
2. Develop and maintain habitat assessment/evaluation, protection, management, and enhancement projects (e.g., artificial water developments and Sonoran pronghorn food plots)
3. Conduct wildlife population surveys
4. Establish game limits for hunting, trapping, and non-game species collection
5. Manage wildlife predators and endangered species/special status species
6. Manage off-highway vehicles in terms of habitat protection and user opportunities
7. Issue hunting permits

Management activities include conducting wildlife censuses to determine population trends, followed by recommendations for restoring or maintaining resident species; controlling wildlife populations at appropriate sustained levels for protection of other BMGR resources values; and enforcing state game laws. AGFD organizes and conducts bighorn sheep surveys every year on BMGR lands, however specific mountain ranges within the BMGR are usually surveyed only every three years. AGFD also conducts research on Sonoran pronghorn through aerial and vehicular tracking of individual animals via radio-collar telemetry (U.S. Air Force 1986). AGFD is also a member of the Sonoran Pronghorn Recovery Team, which also consists of representatives from the USFWS, Luke AFB, MCAS Yuma, NPS, BLM, the University of Arizona, and the Mexican Government (U.S. Air Force, Luke AFB 2000). Although no tribal representatives have committed to be members of the current Recovery Team, Tohono O'odham Nation representatives have occasionally attended the Recovery Team meetings.

AGFD and the BLM jointly prepared the 1997 Lechuguilla-Mohawk HMP. AGFD joined with the BLM and Luke AFB to prepare the 1999 Draft Barry M. Goldwater East HMP. The objectives of these plans include maintenance and enhancement of habitat for Sonoran pronghorn (*Antilocapra americana sonoriensis*), desert tortoise (*Gopherus agassizii*), flat-tailed horned lizard (*Phrynosoma mcallii*), mule deer (*Odocoileus hemionus*), desert bighorn sheep (*Ovis canadensis*), upland game, nongame species, and other sensitive wildlife habitat on the BMGR. To implement these objectives, AGFD is actively engaged in water hole management on the BMGR. This involves the construction and maintenance of man-made and reconstructed natural water catchments and development of support roads (U.S. Air Force 1986).

In managing the state's wildlife, AGFD makes determinations on the appropriateness and need to transplant wildlife, which may include transplants into or out of the BMGR. Should wildlife transplants affecting the BMGR be proposed, a separate environmental analysis to comply with NEPA would be completed prior to implementing any specific proposal.

2.5.2 U.S. Department of Justice, Border Patrol

The U.S. Border Patrol, a unit of the Immigration and Naturalization Service, is responsible for preventing UDAs from illegally entering the United States and apprehending UDAs who have already entered the United States illegally. Because the southern boundary of the westernmost portion of the BMGR shares approximately 37 miles of the international border between the United States and Mexico, many UDAs pass through the range. In fiscal year (FY) 2000, 13,507 UDAs were apprehended on the BMGR (Moore 2001, Colburn 2001a). On the BMGR, the Border Patrol conducts daily reconnaissance by air or ground surveillance. Activities involving the smuggling of drugs or other contraband also occur on the BMGR, although it is less common than in more populated border areas.

There are two Border Patrol jurisdictional sectors on the BMGR, the Tucson and Yuma sectors, divided by the Pima/Yuma County line. These two jurisdictional units, the Tucson and Yuma sectors of the Border Patrol, are responsible for the entire Arizona-Mexico border and portions of the California-Mexico border (in Imperial County). The western unit, the Yuma Sector, includes BMGR lands within Yuma County. The eastern unit, the Tucson Sector, performs operations in Pima, Santa Cruz, and Cochise counties. Within the Yuma Sector, Arizona field stations are located in Wellton and Yuma, and a California field station is located in Blythe. Within the Tucson Sector, the Ajo field station is located near the BMGR in Why, Arizona.

Traditional Border Patrol operations/activities include patrolling roads and off-road areas, dragging unimproved roads to facilitate the observation of foot traffic, conducting aerial reconnaissance, and inspecting vehicles at checkpoints. For the most part, the Border Patrol conducts ground surveillance by observing tracks on drag roads. Drag roads are prepared by

dragging several bolted-together tires across a dirt road or well-used trail in order to assist agents in detecting evidence of illegal crossings by people or vehicles. Currently, the Tucson and Yuma sectors maintain six OH6 Alpha helicopters and three fixed-wing aircraft (two Cessnas and one Piper Supercub) that can provide assistance to any station within the two sectors. There is one established helicopter flight route within the Yuma Sector. Each morning, a helicopter flies from the Yuma station to the U.S.-Mexico border, flies along the border, and returns to the station. This flight takes approximately four hours. The three fixed-wing aircraft are used for higher elevation surveillance and pilot training (Immigration and Naturalization Service 2001).

Border Patrol activities within the Ajo Station area, including the BMGR, consist of road patrols and off-road operations utilizing four-wheel drive vehicles and dirt bikes. No dragging operations are conducted from this field station and air patrol flights are usually related to search and rescue missions (Immigration and Naturalization Service 2001).

Due to the extreme temperatures that occur in southwestern Arizona from May through October, it is necessary that the Border Patrol conduct rescue missions to save UDAs who are severely dehydrated or suffering from other heat-related distress. In recent years, some of the border crossing points that historically have been used the most extensively are being monitored more closely. This has resulted in an increase in crossings of more remote areas, particularly through the Cabeza Prieta NWR and Organ Pipe Cactus NM, but also the BMGR. Because of the remoteness of these areas and the harsh environmental conditions, the Border Patrol's role in rescue missions has also been increasing.

The Border Patrol also offers assistance on the range (and the Cabeza Prieta NWR) to AGFD, BLM, and USFWS. Border Patrol helicopters are occasionally used to locate lost recreationists, report illegal off-road vehicle (ORV) usage, and assist in wildlife management activities (USFWS 2000b). The Border Patrol also maintains distress beacons that may be activated by persons needing rescue services.

2.6 SAFETY AND SECURITY, PUBLIC ACCESS, AND BMGR MANAGEMENT UNITS

The basic purpose of the BMGR is to provide a secure location in which military training activities can be freely conducted without endangering the safety of military or civilian personnel and without interference or interruption. As already noted, the current aviation weapons training ranges as well as the various surface training and ground support areas within the BMGR have been configured to accomplish this basic purpose. This section identifies the current range locations that must be restricted to general public access based on the distribution of these weapons ranges and training and support areas. Conversely, locations within the range that are generally acceptable for accommodating public visitation based on military training support

requirements have also been delineated. Visitation to these areas, however, may be limited to selected times, restricted from selected sites, or otherwise controlled in order to accommodate military use and natural or cultural resource protection goals.

This section also identifies BMGR resource management units that are based on a number of factors including natural landscape features and vegetative communities, safety and security access restrictions, road density distributions, designated special management areas, and natural community conservation elements identified by The Nature Conservancy. The purpose of these units is to define geographically cohesive areas over which natural resources can be managed for consistent purposes.

2.6.1 Safety and Security Restrictions on Access

Safety hazards or security concerns are present on a near continuous basis within many areas of the BMGR and general public access must be restricted from these locations (Figure 2-4).

Approximately 62 percent the of the BMGR falls within this category and must be restricted from public access because of ongoing hazards associated with munitions delivery training, known or suspected high concentrations of UXO on the ground surface, laser use hazards, airfield safety and security, or other safety or security requirements at training or support sites. Safety hazards or security concerns are present within the other 38 percent of the BMGR only at selected times or in selected confined locations, such as an electronic instrument site. These areas of the BMGR can generally accommodate public visitation on a regular basis as long as certain necessary restrictions regarding access to local electronic instrument, training, support, or resource protection sites are observed. Access to the range by all military and civilian personnel is regulated by permit at all times and in all locations. Approximately 80 percent of all range areas open to public visitation are in BMGR—West. The area of BMGR—West open to general public access encompasses about 521,000 acres, which is about 75 percent of the BMGR—West land area. Public access to BMGR—East is limited to about 133,000 acres, which is almost 13 percent of the BMGR—East land area.

Persons wishing to visit the range for personal purposes must obtain a current range permit before entering the range. Persons on official business on the range are not required to obtain a visitor's permit, but do need to attend a safety briefing and to call in prior to going on the range. Each entry to a restricted area of the range is by prior approval only and requires that the visitor report off the range immediately following departure. Persons wishing to visit areas of the range generally open to public access must report their intended visit and range permit number to a telephone call-in service prior to their trip. Persons visiting publicly accessible areas within BMGR—East are also required to call-off the range following the trip. All visitors are advised of irregularly scheduled range closures that may affect areas of the range they intend to visit through

the call-in service. Most of the eastern side of the range (approximately 87 percent) is restricted from general public access, because BMGR—East supports three tactical ranges, four manned ranges, and an air-to-air firing range as well as Gila Bend AFAF, AUX-6, and other training and support areas requiring security (see Figure 2-4). The principal areas within BMGR—East available for general public access are located in Management Unit 6. The larger of the two areas, which is also known as Air Force Special Management Area B, contains about 126,000 acres. The second area is almost 4,100 acres. A third area of about 2,800 acres, located in Management Unit 7 adjacent to the Sonoran Desert NM, is also available to public access. Finally, a road corridor in far western BMGR—East forms a public travel way linking roads that circumnavigate a portion of the Mohawk Dunes in BMGR—West. The location of this loop corridor, which contains about 500 acres, is often mistakenly thought to be part of BMGR—West.

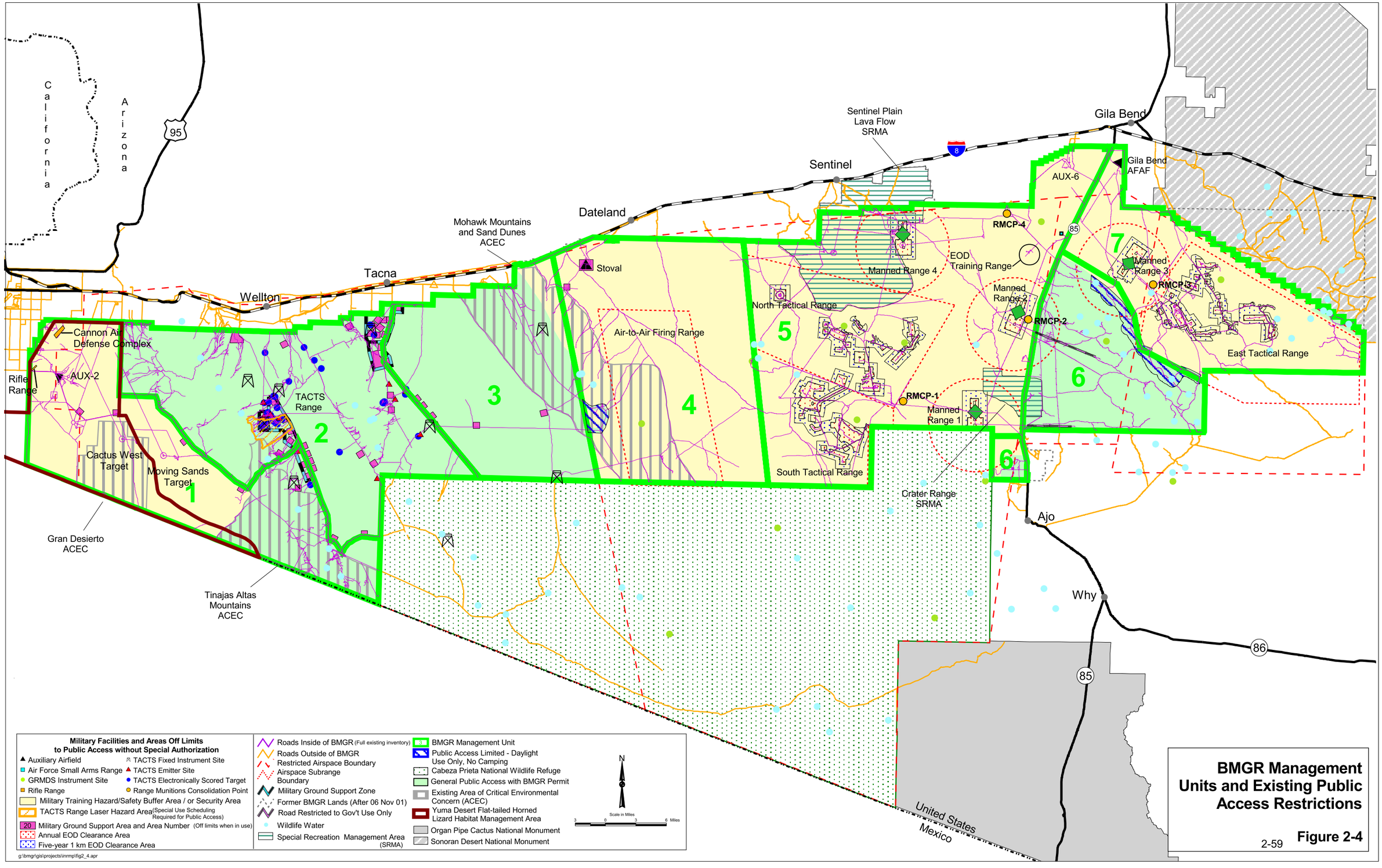
The area of BMGR—West that is available for public use on a routine basis generally lies between the Mohawk Mountains and the Gila and Tinajas Altas mountains but also includes an area along the western footslope of the Gila Mountains. Visitors to this area are currently restricted from all occupied Marine Corps ground support areas, the TACTS Range laser hazard area, and electronic instrument sites. The remaining area of BMGR—West (west of the Gila Mountains) includes locations reserved for the Moving Sands and Cactus West target complexes, AUX-2, the Marine Corps Rifle Range, the Cannon Air Defense Complex, and other potentially hazardous activities. Public access is generally restricted from this area.

2.6.2 BMGR Management Units

Seven management units have been identified within the BMGR; three within BMGR—West and four within BMGR—East (see Figure 2-4). Numbered one through seven from west to east, the surface areas of these units include:

- Management Unit 1 - approximately 230,000 acres
- Management Unit 2 - approximately 265,000 acres
- Management Unit 3 - approximately 195,000 acres
- Management Unit 4 - approximately 280,000 acres
- Management Unit 5 - approximately 440,000 acres
- Management Unit 6 - approximately 138,000 acres
- Management Unit 7 - approximately 188,000 acres

Management Unit 1 includes three existing special management areas—the Gran Desierto and Tinajas Altas Mountains ACECs and the Flat-tailed Horned Lizard Habitat Management Area (HMA). Most of this unit lies within the safety and security restricted area within the westernmost portion of BMGR—West and is off limits to most public visitation. The eastern extent of this unit generally incorporates the Tinajas Altas Mountains ACEC. Although a number of military



BMGR Management Units and Existing Public Access Restrictions

Figure 2-4

operations occur within this unit, the surface effects of these activities are limited to a small aggregate proportion of the entire area. Existing roads provide limited access to most of the unit. The unit includes the full extent of the Yuma Dunes natural community complex (Figure 2-5) and Tinajas Altas Mountains within the United States. The western portion of this management unit is at the lowest elevation, has the least average rainfall of all of the BMGR units, and includes the only portion of the BMGR to drain west to the Colorado River. The creosotebush-bursage desertscrub is the most prevalent throughout the management unit. These valley floor communities are dissected with the valley xeroriparian scrub natural community throughout the lower western drainage of the Gila Mountains as well as the full western drainage and upper portions of the eastern drainage of the Tinajas Altas Mountains within the United States. The Elephant Tree-Limberbush on Xeric Rocky Slopes natural community occurs in this management unit within the Tinajas Altas Mountains. Xeroriparian systems are least prevalent in the western portion of the unit, and increase in the eastern and southern portions of the management unit. The eastern portion of the unit includes tinajas, cultural resources, a population of desert bighorn sheep, an example of the elephant tree-limberbush on xeric rocky slopes natural community, and dissected mountain xeroriparian scrub communities.

Management Unit 2 incorporates a topographically diverse landscape including the Gila Mountains, Copper Mountains, Wellton Hills, and Baker Peaks as well as the Lechuguilla Desert Valley. It includes two examples of the elephant tree-limberbush on xeric rocky slopes natural community. This community and the valley creosotebush-bursage desertscrub community are highly dissected with the valley xeroriparian scrub natural community, which is formed from the extensive drainage system that drains towards the north. To the east of the Copper Mountains there is a Salt Desertscrub natural community. Within the Gila and Copper mountains, there are both managed wildlife water holes and natural springs that are used by bighorn sheep. An extensive array of TACTS Range facilities and Marine Corps ground support areas are located within this unit. With the exception of the TACTS Range laser hazard area, public access is compatible with current military operations throughout most of this unit. This management unit, which includes areas with some of the highest road densities within the BMGR, has long been a popular public outdoor recreation area. From a wildlife management standpoint, Management Unit 2 occupies an area lying between two sensitive habitat areas—the current range of the Sonoran pronghorn in Management Unit 3 to the east and the Flat-tailed Horned Lizard HMA in Management Unit 1 to the west.

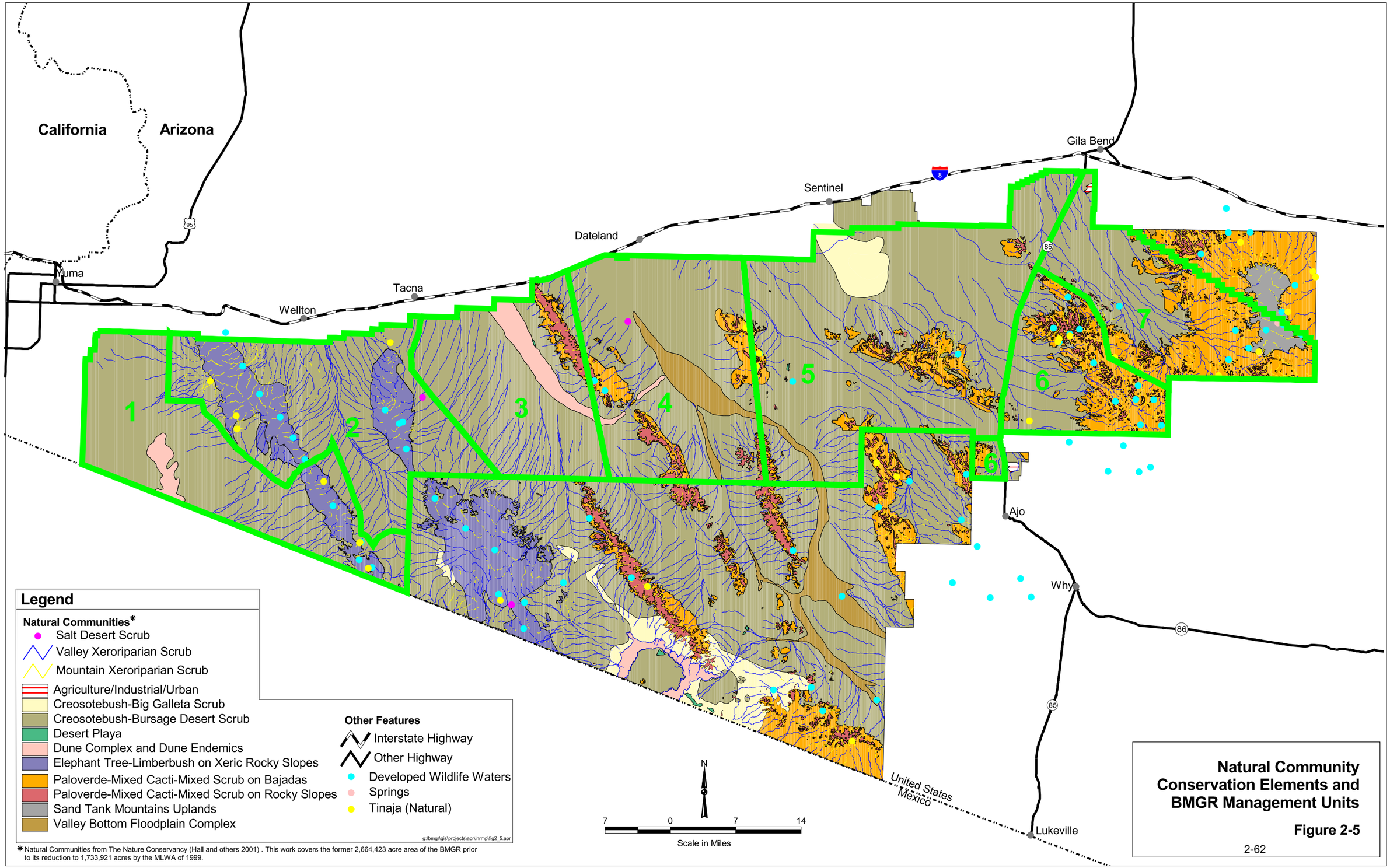
Management Unit 3 occupies the easternmost area of BMGR—West. This unit incorporates a large portion of the Mohawk Mountains and Sand Dunes ACEC and most of the Mohawk Dunes natural community complex. The unit is generally bounded on the east by the Mohawk Mountains but the northeastern corner of the area lies on the eastern side of these mountains. This topographically cut off corner of Management Unit 3 is physiographically within the San Cristobal Valley, but lies administratively within BMGR—West. The unit contains some of the

most extensive unroaded areas within the BMGR. With the exception of the upland slopes of the Mohawk Mountains, the entire unit is within the current distribution of the Sonoran pronghorn, which extends to the east into Management Unit 4 of BMGR—East and to the south into the Cabeza Prieta NWR. The western portion of this unit includes a large expanse of the creosotebush-bursage desertscrub natural community dissected with the valley xeroriparian scrub natural community. The eastern portion of this unit is comprised of the northern Mohawk Mountains, which are vegetated with the paloverde-mixed cacti-mixed scrub communities on the bajadas and rocky slopes. Most of this management unit is within the current Sonoran pronghorn distribution area. Military surface use within Management Unit 3 is limited to five widely dispersed ground support areas and scattered TACTS Range instrument sites. The area is generally open to public visitation, but the rates of visitation are less than those experienced in Management Unit 2. Beginning in 2002, Management Unit 3 is closed to public entry from March 15 to July 15 each year as a part of the overall effort to recover the Sonoran Pronghorn. This timeframe spans the normal period for Sonoran Pronghorn births and is critical to the early survival of pronghorn fawns.

Management Unit 4 includes some of the most remote locations within the BMGR. This unit generally underlies the Air Force Air-to-Air Firing Range and lands north of that range that include Stoval Airfield. Like Management Unit 3 to the west, Management Unit 4 straddles the Mohawk Mountains. As a result, the southwest corner of this unit lies on the western side of these mountains and is often mistakenly regarded as being a part of BMGR—West. This entire unit is restricted from general public access. In addition to the Mohawk Mountains, other notable natural features within this unit include the easternmost extent of the Mohawk Dunes natural community complex and the northern extent of a unique valley bottom floodplain natural community complex within the San Cristobal/Growler Wash drainage system. This floodplain community is located on flat valley bottoms where sheet flow with little or no erosional down cutting is the dominant ecological process. The resulting vegetative community includes dense stands of creosotebush, white bursage, ironwood, mesquites, and annual and perennial grasses. The valley bottom floodplain community within the San Cristobal Wash system is considered to be one of the best remaining examples of this community type in the Sonoran Desert. A Salt Desertscrub natural community is also present along the northern portion of the wash system.

With the exception of mountain upland locations, the entire management unit is within the current distribution of the Sonoran pronghorn. Military surface use within Management Unit 4 currently includes the munitions fallout impact area for the Air-to-Air Firing Range; however, the levels of surface disturbance associated with this use are minimal.

Management Unit 5 includes North and South TAC ranges and Manned Ranges 1, 2, and 4. Although the target impact and EOD clearance areas associated with these ranges represent the most extensive military use areas of the BMGR, most of the surface of this unit remains in a



*Natural Communities from The Nature Conservancy (Hall and others 2001) . This work covers the former 2,664,423 acre area of the BMGR prior to its reduction to 1,733,921 acres by the MLWA of 1999.

Natural Community Conservation Elements and BMGR Management Units

Figure 2-5

relatively undisturbed state. This management unit includes the southern reaches of the San Cristobal valley floodplain complex natural community. While the creosotebush-bursage desertscrub community is dissected with the valley xeroriparian scrub, the paloverde-mixed cacti-mixed scrub communities on the bajadas and rocky slopes are dissected with the mountain xeroriparian scrub. The only example of the creosotebush-big galleta scrub natural community on the BMGR is located in the Sentinel Plain area of this management unit. There are a few managed waters and naturally occurring waters within the Aguila Mountains and Crater Range. The management unit is bound topographically on the west by the Aguila and Granite mountains and to the east by State Route 85. Roughly the western half of this management unit is within the current distribution of the Sonoran pronghorn. Two existing special management areas—the Sentinel Plain Lava Flow and Crater Range SRMAs—are located within Management Unit 5. The SRMA designation of these features is a misnomer; these former Arizona State Natural Areas were provided with this designation to signify geologically outstanding volcanic formations, not special recreation activities. Public access is restricted throughout the unit because of hazards associated with the weapons ranges and other training sites. As a result, the two SRMAs are not used for recreation.

Management Unit 6 includes two separate sub-units. The larger sub-unit lying east of State Route 85 between the Sauceda and Batamote Mountains is also known as Area B. This unit supports a little disturbed example of the paloverde-mixed cacti scrub on bajadas natural community, one of the richest and most diverse natural communities within the BMGR. Coupled with the adjacent Management Unit 7 to the northeast, Management Unit 6 harbors the most extensively distributed and best preserved example of this natural community. Dense saguaro stands are the dominant over-story cactus species. Manmade and natural waterholes are relatively prevalent within the Sand Tank Mountains and there are several natural springs as well. Military surface use in this area is currently limited to the target lead-in-lines to Manned Ranges 1 and 2 and a GRMDS instrument site on Hat Mountain, a prominent flat-topped peak in the central Sauceda Mountains (see Figures 2-1 and 2-4). Public travel on the two target lead-in-lines is not permitted, but general public access is acceptable in the rest of the sub-unit and it is a popular back-country recreation site. The only other access limitation in Management Unit 6 is that the road that roughly parallels and crosses the Management Unit 7 boundary, is restricted to daylight use only. No camping or nighttime travel is permitted along this road because of certain hazards associated with nighttime air-to-ground munitions delivery training in East TAC Range.

The smaller of the two sub-units of Management Unit 6 lies between State Route 85 and Childs Mountain. The southeastern quarter of this sub-unit, which is known as the Ajo Air Force Station area, is compatible with public access. The northern half of the sub-unit provides a safety buffer for munitions delivery training missions at Manned Range 1.

Management Unit 7 includes the easternmost areas of BMGR—East and the most extensive distribution of mountainous uplands in the range units. The Sand Tank and Sauceda mountains form a northwest-opening horseshoe-shaped, continuous ring around the western valley section of this unit. Much of the eastern half of the unit is within the Sand Tank Mountains uplands. These mountains support the only example of the Sand Tank Mountains Uplands natural community within the BMGR and, as already noted, the paloverde-mixed cacti scrub on bajadas natural community is also widely distributed within the unit. There are some manmade and natural waters, primarily in the eastern portions of the unit and a natural spring within the Sand Tank Mountains upland natural community. The Gila Bend AFAF, located in the northern portion of this unit, is the only industrial/urban area identified within the BMGR. Military surface use is generally confined to the northwestern valley areas of the unit and includes Manned Range 3 and East TAC Range (see Figure 2-4). Gila Bend AFAF occupies the northernmost extension of the unit. General public access is not compatible with the military activity within nearly all of this unit because of ongoing munitions delivery training missions, high UXO concentrations, targeting laser use, and airfield security requirements. Public entry to Management Unit 7 can be accommodated in only two areas. One location includes a narrow area in the northeasternmost corner of the unit between the East TAC Range and BMGR boundaries known as the Benber Springs area. The other area includes two locations along the Management Unit 6 and 7 boundary where a road open to public travel traverses portions of Management Unit 7 (see Figure 2-4). This road is for daylight use only. Overnight camping and nighttime travel is prohibited along this road.

2.7 NATURAL AND CULTURAL RESOURCE MANAGEMENT OPPORTUNITIES AND CONSTRAINTS

Natural and cultural resources management opportunities arise from the combination of circumstances that are favorable for meeting management goals, objectives, or other requirements. Constraints are those factors that limit or alter those natural and/or cultural resource management opportunities. For the proposed INRMP, the opportunities and constraints analysis is a synthesis of military mission and non-military agency requirements, recreation, what is known about the resource base, and suitable public uses—all of which are subject to change. Thus, the consideration of natural and cultural resource management opportunities and constraints also contributes to the resource monitoring and adaptive management framework inherent in the planning and management philosophy, to be further detailed in Section 2.8.

2.7.1 Military Mission and Non-Military Agency Opportunities and Constraints

Pursuant to the MLWA of 1999 and the Sikes Act, the predominant drivers of natural and cultural resource management at the BMGR are support of the military mission, conservation and

protection of natural and cultural resources, and support of ecologically sustainable public use subject to military safety and security requirements. In accordance with these Acts, supporting the military mission of the range is essential and, therefore, the first priority of the proposed INRMP. Some of the military requirements, such as training in the delivery of live ordnance, is a constraint to conserving and protecting natural and cultural resources and also to providing public use. Likewise, conservation and protection of natural and cultural resources may be a constraint to public recreation opportunities. For example, beginning in 2002, public access to Management Unit 3 is restricted from 15 March to 15 July each year to reduce potential harassment pressures on Sonoran pronghorn during fawning season. However, within the confines of the military land use requirements detailed in Section 2.2, there are also various opportunities for natural and cultural resource management as well as public use. In fact, given the character of the military mission at the BMGR and the long-term environmental protection that military use has afforded to most of the range, there are opportunities to use, protect, and conserve resources and latitude available to develop effective management methods. Optimizing those opportunities for meeting biodiversity and stewardship management objectives in a manner integrated with operations/training requirements is the most effective means for serving both the operational and environmental conservation requirements of the military mission.

Within BMGR—East, the primary military constraints are the target impact areas associated with the tactical ranges and manned ranges. Either live or inert ordnance, or both, are repeatedly delivered to these targets, resulting in high levels of disturbance to soils and vegetative communities. While such impacts are generally confined to a relatively small area, these features are critical to the military mission and must be retained. Impacts that have occurred and will continue to result from these activities may limit some natural and cultural resource management opportunities in terms of multiple uses. Natural and cultural resource management is primarily compliance based, doing that which is necessary to mitigate unavoidable impacts and sustain those ecological conditions necessary to support the mission. In these areas, military use also precludes opportunities for other uses that are incompatible with the military mission, including recreation. Just beyond these core target impact areas, military effects are generally associated with the annual and five-year EOD clearance requirements. In these areas, the surface impact of military use is not predominant, natural processes are less affected, and the vegetation and soil are in state of sustainable recovery. While natural and cultural resource preservation cannot be guaranteed based on the need for military operations in these areas, the Air Force has actively been inventorying these areas for natural and cultural resources and acknowledges the opportunities to conserve and protect these resources. Such stewardship is good business for the DoD in retaining the BMGR land withdrawal as a military reservation. In addition, because non-military uses are precluded from these areas for safety and security reasons, the mission supports the opportunity to protect resources. These areas may provide opportunities for natural and cultural resource management, such as wildlife management projects that are compatible with the mission.

Other military use areas, such as the Air-to-Air Firing Range, have resulted in even less ground disturbance. The land underlying the Air-to-Air Firing Range is subject to fallout from weapons delivery and some target debris. Because of the nature of the training, non-military land uses are not allowed, yet there is no core area of impact. Similarly, buffer areas between the tactical and manned ranges are closed to public use for safety and security reasons, yet have almost no military impact beyond errant munitions striking there. This affords an exceptional opportunity for resource conservation and protection, which is particularly valuable in that the land is generally in a natural condition from the decades of having precluded other land use. The necessary limitations on public use for safety and security reasons may be viewed as an opportunity for the implementation of those resource management projects that could have conflicts with recreation use elsewhere on the BMGR. For example, the endangered Sonoran pronghorn would not be disturbed by recreationists in these areas, which may promote the success of an ongoing project to develop enhanced forage growth in selected plots.

The impacts from military use at Gila Bend AFAF, AUX-6, and adjacent lands are concentrated in those areas most modified and frequently used in support of the military mission. Recreational use of these areas is necessarily limited. Within the Gila Bend AFAF area, natural conditions have been altered substantially. Thus, resource management opportunities differ from those elsewhere on the BMGR and may be redirected to matters such as the use of environmentally beneficial landscaping practices. Resource management opportunities in the less developed AUX-6 area are somewhat parallel to those areas within the weapons ranges that are affected by military use, but retain resource values. Thus, conservation and protection goals and objectives focused on the AUX-6 area would be relatively unconstrained by military and non-military requirements.

The Ajo Air Force Station area and Area B of Management Unit 6 are generally open to public access. Recreational land uses may constrain the potential to conserve or protect some resources in their most natural state, but opens the opportunity for people to enjoy the natural environment. Both the Sikes Act and MLWA of 1999 provide that sustainable public use of the BMGR be supported to the extent that it is consistent with the military purposes of the range. Together, these Acts also require that natural and cultural resources be conserved, protected, and rehabilitated. The challenge here is in determining the extent to which public use is sustainable relative to the requirements to conserve, protect, and rehabilitate the resources of the range. This balance would likely differ depending on the character of the public use activity and the sensitivity of the resources.

BMGR—West has similar opportunities and constraints regarding the balance of military use, resource management, and public use, but in different proportions. Most impacts of military use occur within the developed areas of the Moving Sands and Cactus West Target Complexes, AUX-2, and the Cannon Air Defense Complex. Although the impact areas are relatively small, entry to a sizable portion of BMGR—West, west of the Gila and Tinajas Altas mountains, Foothills Boulevard, and the western alignment of El Camino del Diablo, is restricted at all times

to authorized personnel. The primary management objective for these areas must be in support of the military mission. However, outside of the primary impact areas, there are outstanding opportunities for resource conservation, particularly due to the limitations on access. Currently, the HMA for the flat-tailed horned lizard, a special status species, and the Gran Desierto Dunes ACEC encompass much of this area.

The military use within the remainder of BMGR—West is in support of the ground support areas and TACTS Range. There is no requirement to restrict military or civilian personnel from entering most locations within this portion of BMGR—West at most times. With the exception of frequently used portions of ground support areas and simulated target and electronic instrumentation sites, natural conditions predominate in these areas, as is recognized by the Mohawk Mountains and Sand Dunes and Tinajas Altas Mountains ACECs. There are excellent opportunities for recreation use, if compatible with resource conservation and protection requirements.

Non-military agency land use, particularly that of the Border Patrol introduces a secondary layer of uses that influence natural and cultural resource management. Although providing for the requirements for non-military land use are not specifically outlined in the Sikes Act or MLWA of 1999, other national priorities support the performance of this and other agencies' missions in relation to natural and cultural resource protection requirements and goals. The Border Patrol law enforcement and search and rescue missions, which require some off-road vehicle use, have some impact on BMGR resources and may be contrary to some resource conservation goals. The AGFD mission, on the other hand, is focused on resource management. Various wildlife management opportunities are present as a result of past and ongoing AGFD wildlife management programs such as wildlife water developments.

2.7.2 Resource Opportunities and Constraints

While executing the military mission sometimes constrains and sometimes supports the ability to conserve and protect environmental resources, the resource base itself factors into the analysis of resource management opportunities and constraints. An adequate understanding of the resource base, particularly those vulnerable or high-value resources, provides an additional frame of reference. It provides insight into those areas where opportunities for resource management are greatest in terms of resource protection, conservation, enhancement, or recovery. It also identifies those areas where resource conditions may constrain opportunities for use, whether it be military use, non-military agency use, or recreation use.

Luke AFB has partnered with The Nature Conservancy for technical support in the development of this EIS and the proposed INRMP. Specifically, The Nature Conservancy provided expertise in site conservation planning, a planning methodology that uses a focused set of conservation

elements to represent the overall native biodiversity of an area within a planning and management context. A number of recognized scientific and agency natural resource experts were engaged in this process to help identify relevant existing ecological, conservation status, threat, and regional biodiversity data. With the assistance of these experts, the Nature Conservancy analyzed the ecological structure, composition, and processes on the BMGR and identified 13 natural community elements (see Figure 2-5) (Hall and Others 2001). Natural communities represent an integration of ecosystem attributes, including biotic and abiotic composition, structure, and function, at scales that are practical and applicable to conservation planning. These communities in combination represent a coarse filter, which is intended to capture, for management purposes, the majority of the biodiversity occurring on the BMGR. The Nature Conservancy also identified 12 species conservation elements for the BMGR. Some of these species conservation elements are individual species while others are guilds composed of at least three or more species.

From this baseline, The Nature Conservancy effort focused on a vision for managing each of these elements and measuring whether management actions are successful in meeting management goals. Against the backdrop of ecological processes that maintain ecosystem function in the Sonoran Desert, a preliminary list of monitoring objectives was developed for each of the 13 natural communities and 12 species conservation elements. Lastly, The Nature Conservancy effort examined opportunities and obstacles for coordinated management with two adjacent landowners—the Cabeza Prieta NWR and Tohono O'odham Nation.

The ecological characteristics of the community and conservation elements; its status, threats to its persistence, and associated threat abatement strategies; and mapping and information needs were documented. These efforts and analyses can be used in the proposed INRMP to further focus on those areas that present the greatest opportunities for natural and cultural resource management. That is, the conditions necessary to sustain native species, ecological communities, and biological diversity. These efforts also helped to define what is important in terms of ongoing monitoring and evaluation of the status and stability of natural communities.

Another important opportunity for natural and cultural resources management results from the areas previously recognized and managed for resource conservation and protection areas on the BMGR (ACECs, SRMAs, HMA, and the backcountry byway). These areas offer opportunities for continuing, expanding, or refocusing management efforts, compatible with the military mission, that are consistent with the legacy of prior management efforts. Military use is generally not predominant (particularly within the ACECs and HMA) and controls on recreation use, where currently allowed, have already been established in these areas.

Currently recognized resource constraints are primarily driven by compliance requirements such as the protection of cultural resource sites, which must be adequately protected from potential impacts from military, non-military agency, or public use. It also includes incorporating environmental considerations into planning, such as suitability of military or non-military agency

operations or intensive recreation use in areas with soils that have limited weight-bearing capacity or high potential for erosion. Requirements for protection and recovery of the Sonoran pronghorn already constrain military and non-military agency operations, requiring various mitigative measures, and future limitations on recreation use may be required. Whereas recovery of the species would lessen constraints on users, further decline of the species may introduce additional constraints. The INRMP must look forward, with ecosystem and biodiversity interests in mind, and consider these types of resource management constraints or vulnerabilities.

2.7.3 Public Use Opportunities and Constraints

Again, based on the legal authority of the Sikes Act and MLWA of 1999, opportunities for sustainable public use of the BMGR must necessarily be constrained by requirements for military use. The predominant opportunity for public use consistent with military missions is recreation. The MLWA, DoD Native American Policy, and the American Indian Religious Freedom Act also specify special provisions for access to and ceremonial use of sacred sites by American Indians.

The resource base present at the BMGR could support a wide range of outdoor recreation uses. However, many potential activities, such as cross-country ORV races or developed campgrounds, are precluded from consideration by military mission or other regulatory constraints. As it is, most BMGR recreation use currently consists of dispersed hunting, backpacking, hiking, dispersed and undeveloped camping, photography, backcountry vehicle driving, and sightseeing. Although similar recreational opportunities are present in the region, opportunities at the BMGR setting are unique in terms of both its environmental and military context. There are no developed recreation sites or facilities on the BMGR. All recreational access to the BMGR is by permit only. Additional AGFD permits must be obtained for hunting. Areas on the BMGR currently open to regular AGFD hunting seasons include Management Units 2, 3, and 6 and the portions of Management Units 1 and 7 open to public access. A portion of Management Unit 4 along the Mohawk Mountains is also open to big horn sheep hunters under an Air Force Special Use Permit. Recreational users of the BMGR are expected to comply with general rules of conduct for public lands, which address sanitation; terms of occupancy; vehicle use; natural and cultural resources; and health, safety, and comfort. Although there is some demand for public off road use, such recreational travel is currently prohibited on the entire BMGR.

These types of recreation uses can and are likely to impact natural and cultural resources to at least some degree. The requisite management task is to determine the extent to which various types of public use may be sustained relative to requirements to conserve, protect, and rehabilitate the resources of the range.

2.8 INRMP PLANNING AND MANAGEMENT PHILOSOPHY

The DoD approach to integrated resource management planning is central to the proposed INRMP. This proposed plan also relies on the application of biodiversity and ecosystem management concepts. These concepts are critical to understanding the development and application of the INRMP. The following three important and interrelated facets of ecosystem management are needed in order to put this planning and management philosophy into practice for the BMGR: (1) addressing ongoing management issues, (2) developing a resource monitoring program that is based on ecological principles, and (3) establishing an adaptive management program. Although presented sequentially, these components are actually interactive and activities related to them would often be concurrent. Planning is rarely linear because knowledge increases and conditions (both environmental and military mission) change, necessitating revision of earlier management measures and adaptation of future management measures. Implementing management measures, monitoring the results of those management measures and changing conditions, and adjusting management accordingly sets in motion a continuing and dynamic management process. Thus, the proposed INRMP is the tool that is used to apply the DoD ecosystem planning and management philosophy to the BMGR. Section 3.2 in Chapter 3 initiates the first step in this process by establishing goals on which to base the plan.

2.8.1 Biological Diversity, Ecological Integrity, and Ecosystem Management Defined

The definitions used in this EIS were derived from DoD Instruction 4715.3, *Environmental Conservation Program*. Biological diversity, sometimes shortened as biodiversity, and ecological integrity, a term interchangeable with ecological health, are both measurements of ecosystems—dynamic and natural complexes of living organisms interacting with each other and with their associated non1iving environments. Biological diversity refers to the variety of life forms and processes and the environment in which they occur. It includes the number and variety of living organisms, genetic differences among them, communities and ecosystems in which they occur, and ecological and evolutionary processes that keep them functioning, yet ever changing and adapting. Ecological integrity refers to the ability to support and maintain a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to the natural habitat of the region.

Ecosystem management incorporates the concepts of biological diversity and ecological integrity in a process that considers the environment as a complex system functioning as a whole, not as a collection of parts, and recognizes that people and their social and economic needs are a part of the whole. In its application, a goal-driven approach is used to manage natural and cultural resources in a manner that supports present and future mission requirements; preserves ecosystem integrity; is at a scale compatible with natural processes; is cognizant of nature's timeframes;

recognizes social and economic viability within functioning ecosystems; is adaptable to complex and changing requirements; and is realized through effective partnerships among private, local, state, tribal, and federal interests. Traditionally academic disciplines such as ecology, biogeography, population genetics, economics, sociology, philosophy, and other disciplines are synthesized and applied to the maintenance of biological diversity. Because ecosystem management is based on an emerging understanding of ecology, biological diversity, and resources management, and because ecosystems are open, changing, and complex systems, this planning and management philosophy requires flexibility. Provisions to allow for adaptive management include monitoring, assessment, reassessment, and adjustment as necessary.

2.8.2 Addressing Ongoing Management Issues

As defined in Section 2.3.3, resource management issues have been addressed at the BMGR since its inception during World War II. The contemporary resource management era, however, can be traced from 1982 with the development of the Natural Resources Management Cooperative Agreement between the Air Force, Navy/Marine Corps, USFWS, BLM, and AGFD. That agreement led to the production of the Luke Air Force Range Natural Resources Management Plan in 1986, which was in turn adopted by the BLM as the basis for preparing the Goldwater Amendment that was completed in 1990. These three events led to the recognition that effective resources management on the BMGR depends on clearly identifying the land and airspace use requirements of the military mission, addressing natural and cultural source management issues from a broad scope and an integrated perspective, promoting resource protection and conservation opportunities created by military use requirements, and emphasizing interagency communications and cooperation on BMGR resource management issues. Progress on all of these fronts has been made since the Goldwater Amendment was implemented. An essential task of the proposed INRMP will be to maintain progress on these continuing management issues while integrating measures to support sustainable public use.

A number of resource-specific management issues that were identified during the development of the Luke Air Force Range Natural Resources Management Plan and the subsequent Goldwater Amendment have remained current over the last decade and were identified during scoping by the public and agencies as ongoing concerns. Examples include the creation, maintenance, and use of roads within the BMGR; development and maintenance of wildlife waters; recovery of the Sonoran pronghorn; public access and vehicle use procedures and restrictions; and native wood use for campfires. Effective management direction must be established by the proposed INRMP to address these and other ongoing concerns.

The proposed INRMP's integrated management approach requires that ongoing and emerging resource issues not be addressed independently, but in relationship to each other and to ecosystem

and biodiversity management concerns. Thus, management goals and strategies for issues such as road development and vehicle use must be prepared and balanced in view of their potential effects on other resource elements, such as special status species, wildlife habitat, and cultural resources.

2.8.3 Resource Monitoring Program

The uncertainty and complexity of nature means that ecosystem management can never be precise, and all possible outcomes of management will not be known or controllable. Management actions that are deliberately experimental can be used to probe the behavior of the natural system and provide a way of managing under conditions of uncertainty. Developing and testing hypotheses helps identify the important assumptions we make about how an ecosystem functions. Thus, an experimental framework is not just about enabling managers to modify management alternatives to make them more effective; its greatest value lies in its ability to build knowledge and understanding, which continuously enriches the management process.

As the results of selected management activities become known, their implications are analyzed, models are validated and adjusted, and management alternatives are revisited. This is a cycle of learning, where today's future context becomes tomorrow's present and a new future context is envisioned. Resource monitoring involves measuring and reporting results and is, therefore, the tool for measuring the effectiveness of the proposed INRMP once it is implemented. Openly reporting monitoring results promotes accountability for BMGR stewardship, strengthens institutional memory (preserves lessons learned), invites review and comment from outside resource management professionals and the public, and helps communicate management alternatives to others that use the BMGR or manage nearby lands.

Two general approaches to monitor resources are candidate management tools for the BMGR and may be used individually or in combination. The first monitoring approach uses a program specifically designed to detect and track either the environmental effects and management effectiveness of specific resource management actions or the environmental effects of specific activities within the range that are not resource management actions. The second approach is to design a program that will detect and track conditions and trends within selected natural communities and species conservation elements within the BMGR. Similar data collection methods may be used to implement either of these two general monitoring approaches, but the focus and objectives of these approaches would differ. A monitoring program designed under the first approach would be expected to have a narrowly defined focus oriented towards determining the effects and/or results of a specific action or activity. Useful results may be expected from this type of monitoring over either relatively short or long time frames. Potential examples of this approach include monitoring programs designed to:

- track the introduction and spread of invasive plant species along road corridors and in other vehicle use areas within the range
- determine wildlife use of a new water development
- determine the extent of firewood gathering by recreational visitors
- determine the effectiveness of dust abatement procedures
- track the frequency and extent of off-road vehicle use along a specified road corridor or in a particular area

Monitoring programs developed under the second approach would likely have a broadly based focus designed to detect and track trends in the ecological health, structure, or functions of the targeted natural communities or species conservation elements. Although the effects of specific management actions or activities on the range may be detected by such a monitoring program, the program objectives may not be designed specifically to gauge those effects. The program monitoring methods may also not be sensitive to measuring changes in the targeted conservation elements that result from other unforeseen causes. The full usefulness of results from this type of ecosystem monitoring may be realized only over relatively long time frames.

2.8.4 Adaptive Management

In simple terms, adaptive management involves a preplanned process designed to continue, modify, or redirect management objectives or actions in response to changing conditions or new information in order to best achieve desired goals. A key to this definition is the concept that adaptive management requires a preplanned process. An adaptive resource management program is implemented in recognition that change in the resource base, management information, and/or other conditions is inevitable over time and that a preplanned process must be in place to measure these changes and develop appropriate responses to maintain or improve the program's effectiveness. This approach differs from a program that relies solely on periodic management plan updates in that the adaptive program anticipates and adjusts to changing conditions as they emerge rather than deferring management action until a previously scheduled update cycle runs it course.

A key cornerstone of a successful adaptive management program, that also incorporates ecosystem management principles, is a resource monitoring system that provides feedback on the effects of implemented management actions and, as well, gauges both the baseline conditions and trends that characterize natural communities and species conservation elements. Such a monitoring system engages the advantages of both of the monitoring approaches—action and response and ecosystem monitoring—discussed in Section 2.8.3. This duel monitoring approach would be beneficial to the BMGR where limited baseline information and no trend analysis are available to characterize most natural communities and species conservation elements and no

systematic assessments of the effectiveness of management actions have been previously implemented.

A second critical component of adaptive resource management at the BMGR would be clear channels for both inter-agency consultations and public and tribal participation. The multiple agency character of resource management and land use within the BMGR as well as active public interest in these issues has been well demonstrated. Effective management of the range's natural and cultural resources could not be achieved without active communication among the agencies that manage and use those resources and with those members of the public, non-governmental organizations, and Native American tribes with interests in those resources.

CHAPTER 3
DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

3.1 OVERVIEW OF THE ALTERNATIVES

This EIS addresses five alternative strategies, including the proposed action and no-action alternative, for managing natural and cultural resources and public access within the BMGR. Each of these alternative management strategies represents a potential resource management framework that could be implemented as the INRMP for the BMGR. The alternative or combination of alternatives selected in the forthcoming ROD for this EIS will constitute the management framework that will be implemented. Following publication of the ROD in the Federal Register, the INRMP document will be prepared based on the selected management strategy and other material extracted from the ROD and final EIS. Thus, the INRMP will implement the resource management strategy selected through the EIS process.

The five alternative management strategies were developed in accordance with NEPA. The management strategy framework for the BMGR will be chosen after a rigorous analysis has identified the environmental impacts of reasonable alternatives for managing the resources of the range in comparative form. The selection of the reasonable management alternatives addressed in this EIS was guided by criteria that included statutory and regulatory guidance and BMGR resource management goals developed during the EIS process. The selection criteria and resource management goals are presented in Section 3.2. The resource management goals were developed in view of applicable statutory and regulatory guidance; the needs of the military mission of the range; public and tribal viewpoints gathered through scoping, workshops, and other avenues of participation; input regarding the management missions and needs of the USFWS, AGFD, and U.S. Border Patrol; and the specific qualities of BMGR natural and cultural resources (see Sections 1.3, 1.8, 2.2, 2.5, 2.6, 2.7, and 3.2). The MLWA of 1999 and the Sikes Act provided the principal statutory guidance for developing the alternative management strategies, but the consistency of each alternative with the ESA and the NHPA was also specifically considered. Each alternative was also developed in view of guidance provided by DoD Instruction 4715.3, Air Force Instruction 32-7064, and Marine Corps Order P5090.2A, which direct natural resources management on military installations in accordance with the Sikes Act and other statutory and regulatory law (see Section 2.4).

Although military mission requirements are generally the priority land use determinants for the BMGR, this does not mean that alternative management strategies only address actions directly supporting the military mission. Management actions that indirectly support the military mission or that are neutral in their effect on the current or future military mission are also important components of the proposed INRMP. For example, those management practices that enhance the biological health of the range or the security of its cultural resources could help to prevent

unnecessary conflicts between military operations and resource protection requirements and, as a result, lend support to the continuing use of the BMGR for military purposes. Those public uses that are compatible with the military mission similarly benefit from an underlying ecosystem that is intact, resilient, and functional. The INRMP planning process was specifically designed to assess resource management proposals and alternatives that support military mission and resource protection and conservation requirements.

In accordance with the MLWA of 1999 and Sikes Act, the minimum qualifying requirements for each resource management alternative studied in the development of the proposed INRMP are to:

- support the use of the BMGR to ensure the preparedness of the armed forces
- provide for proper management and protection of its natural and cultural resources (which is to include natural resource conservation and rehabilitation)
- provide for sustainable multipurpose public access and use of the range consistent with the requirements of its military purposes

Alternatives that were inconsistent with these overall requirements were eliminated from detailed study (see 40 CFR §1502.14(a) and 32 CFR §989.8(c)). Four alternative management strategies that are consistent with the requirements of MLWA of 1999 and Sikes Act and other applicable regulatory guidance were developed during the public scoping and workshop phases of the EIS planning process for the proposed INRMP. These four strategies, identified as A through D, were designed to represent the full spectrum of management requirements and issues identified during these early planning phases. Each alternative outlines resource management guidance for each of 17 separate areas of resource management (hereafter referred to as management elements). Following the scoping and workshop phases, a proposed management strategy for the long-term management of natural and cultural resources within the BMGR (which hereafter is referred to as the proposed action and is not identified by a letter) was identified. This proposed action combines various management elements from each of the initial four management strategies to form a fifth, separate, composite management alternative. Although additional composite variations in the management prescriptions defined by the four alternative management strategies could be developed, the alternatives presented represent the relative range of actions that are both needed for the BMGR and are appropriate to the special statutory guidance that governs resource management on military installations. A summary of Alternative Management Strategies A, B, C, and D follows. These alternatives were the first four developed in the course of the EIS planning process for the INRMP. Detailed descriptions of these alternatives appear in Section 3.4. The proposed action is a composite alternative that lies within the overall parameters of Alternative Management Strategies A, B, C, and D. The proposed action is not summarized in this section, but is described in detail in Section 3.4.

Alternative Management Strategy A represents the no-action alternative, which is required by NEPA and serves as the baseline condition. In this case, the no-action alternative would be to continue the ongoing management practices of the Goldwater Amendment and established Habitat Management Plans rather than to develop new management practices through an INRMP. While some people are satisfied with the management practices established by these plans, the Goldwater Amendment and existing HMPs were also criticized by some interest groups and individuals prior to and during scoping for providing minimal protection of and conservation for natural resources. In spite of the criticisms, Alternative Management Strategy A is regarded as reasonable as it represents the no-action alternative and is consistent with Section 3031(b)(3)(E)(viii) of the MLWA of 1999, which supports incorporating existing plans in the proposed INRMP to the extent the Secretaries of the Air Force, Navy, and the Interior determine to be appropriate. The existing plans are also compatible with the military mission of the BMGR, provide measures for resource protection and conservation, and support public use that is both compatible with the military mission and the prescribed resource protection and conservation measures.

Some components of the existing plans would require modification before they could be implemented under the Sikes Act. For example, because the proposed INRMP must be prepared in accordance with the Sikes Act rather than FLPMA—the statutory guidance under which these existing plans were prepared—some special management designations (such as ACECs and the El Camino del Diablo Backcountry Byway) could no longer exist pro forma. The effective elements of those designations, however, could be continued through alternative actions authorized under the Sikes Act. Existing public access and recreation opportunities would be retained under alternative Management Strategy A. Existing wildlife management practices would also continue and there would be no defined shift in emphasis towards ecosystem management methods.

Alternative Management Strategies B, C, and D were developed in conjunction with Strategy A to reflect the spectrum of public opinion received during scoping regarding motorized access, resource protection and conservation, and acceptable approaches to wildlife and ecosystem management. The range of management options represented by these four strategies also provides a basis for performing a comparative assessment of the relative environmental effects that would occur as a result of varying the levels of both public use and selected resource management activities.

In contrast to the other alternatives, Management Strategy B would support the greatest degree of motorized access to the BMGR, including potentially expanding the road network available for public use. Strategy B provisions would still have to remain compatible with the military mission and the maintenance of a functioning natural ecosystem. This alternative would provide for the application of resource protection and conservation measures, but its focus would be on resource-specific monitoring, targeted wildlife management actions (such as continued

development and maintenance of wildlife waters), and basic compliance with regulatory requirements. Strategy B also includes a proposal for the construction of two new roads that would create a vehicle bypass route around the northwest corner of the Cabeza Prieta NWR. The purpose of this bypass would be to give U.S. Border Patrol and other law-enforcement personnel a patrol route that is an alternative to operating their vehicles on administrative trails within the Cabeza Prieta Wilderness. Strategy B would allow the existing special management area designations for ACECs, SRMAs, and the backcountry byway to expire in favor of managing these areas in the same manner as other BMGR locations. In contrast, Strategy A would limit public use roads to those currently in existence and would maintain the existing special management area designations.

Alternative Management Strategy D represents the opposite end of the spectrum from Strategies A and B by proposing the most limits on motorized access and public use activities, no Cabeza Prieta Wilderness bypass roads, conservation of unroaded blocks of land of 3,000 acres or more, and the greatest emphasis on adaptive management methods incorporating feedback from ecosystem monitoring. The development of new permanent wildlife waters would be suspended under this strategy pending the outcome of a detailed review of the beneficial and adverse effects of water developments on the BMGR.

Alternative Management Strategy C strikes a balance between Strategies A and B and Strategy D. Compared to Strategy B, Strategy C would place more limitations on public access and use, principally as a result of either road closures or restrictions on public access to selected roads. The Cabeza Prieta Wilderness bypass roads would be permitted under this strategy. Strategy C would emphasize ecosystem monitoring, adaptive management, and resource protection actions to a greater degree than Strategy B. The development of new permanent wildlife waters would be limited to up to six high-priority waters pending the outcome of a detailed review of the beneficial and adverse effects of water developments on the BMGR. The conservation of unroaded blocks of land of 3,000 acres or more is also a Strategy C provision.

3.2 RESOURCE MANAGEMENT GOALS AND ALTERNATIVES DEVELOPMENT HISTORY

3.2.1 BMGR Resource Management Planning History

The INRMP for the BMGR is being proposed as a new range-wide management plan under the guidance provided by the MLWA of 1999 and the Sikes Act rather than as an update or supplement to existing management plans. The existing range-wide resource management plan for the BMGR, the Lower Gila South Resource Management Plan (Goldwater Amendment) was prepared by the BLM (U.S. DOI, BLM 1990b) in accordance with the MLWA of 1986 (P.L. 99-606) and FLPMA. The scope of the Goldwater Amendment is of a general nature in that this plan

established overall natural and cultural resource management direction for the range and prescribed that a series of component subplans be prepared to determine guidance for specific management issues and locations. Included among the subplan requirements are specifications for habitat management plans (HMPs) and a transportation plan. An HMP titled "*Lechuguilla-Mohawk Habitat Management Plan and Environmental Assessment*" (U.S. DOI, BLM Yuma Field Office and AGFD 1997) has been finalized and partially implemented for BMGR—West. A draft HMP titled "*Draft Barry M. Goldwater East Habitat Management Plan and Environmental Assessment*" (U.S. DOI, BLM Phoenix Field Office and others 1999) has been developed but not finalized for BMGR—East. Development to date on the transportation plan has included data collection on the BMGR road system but has not included the preparation of a draft plan document.

A provision of the MLWA of 1999 would permit incorporating existing management plans in the INRMP to the extent that such plans are appropriate to the future management of the BMGR [P.L. 106-65 §3031(b)(3)(E)(viii)]. There is precedence for incorporating material from an existing plan in the development of a new resource management plan for the BMGR. The Goldwater Amendment was prepared as a direct modification of the *Luke Air Force Range Natural Resources Management Plan* (U.S. Air Force 1986).[28]

The Goldwater Amendment and its attendant subplans were evaluated early in the INRMP planning process to determine the extent to which these plans could either serve as a framework for the new INRMP or could contribute to the new plan. This review found that while some components of the Goldwater Amendment and its attendant subplans provide management concepts of potentially continuing merit, these plans overall would not serve adequately as a framework for preparing the next generation of resource management plans for the BMGR. Consequently, the proposed INRMP will be prepared as a new range-wide plan rather than as a modification of or amendment to the previous BMGR management plans. A number of factors led to this conclusion. First, the Goldwater Amendment and its predecessor, the *Luke Air Force Range Natural Resources Management Plan*, were based on military mission, environmental, and management information from the early to mid-1980s, which no longer represents current conditions.

Second, the MLWA of 1999 transferred primary responsibility for land management on the BMGR from the DOI BLM to the Marine Corps, via the Secretary of the Navy, and Air Force. An important change coincident with this transfer in land management jurisdiction is that guiding statutory authority for the resource management plan shifts from FLPMA to the Sikes

[28] The BMGR was known as Luke Air Force Range before being renamed as the Barry M. Goldwater Air Force Range (now shortened to Barry M. Goldwater Range) by Congress, through the MLWA of 1986, in honor of then retiring Arizona Senator Barry Goldwater for his long service to the Nation as a member of the U.S. Senate and U.S. Air Force.

Act.[29] FLPMA directs that resources be managed to support a balanced mix of various land uses. In contrast, the Sikes Act and DoD policies and regulations for its implementation establish that land management must support the military mission of the installation over all other elective uses. Some regulatory uses (such as endangered species protection) may take precedence over all other uses including some military activities, but military needs are not to be curtailed until all other options, including suspending other uses such as public access, have been explored. The Sikes Act directs that the management program must provide for the conservation and rehabilitation of natural resources, sustainable multipurpose public use of those resources, and public access that is consistent with safety and military security requirements [16 U.S.C. 670(a)(3)]. No relative priorities among resource conservation and rehabilitation, multi-purpose public use, and public access are assigned by the Act except that the use must be sustainable and consistent with the needs of fish and wildlife resources. DoD Instruction 4715.3 provides that management under the Sikes Act should emphasize ecosystem rather than single species management principals and that public use must be compatible with ecosystem sustainability. The only way to ensure that the actions prescribed by the proposed INRMP for the BMGR would (1) meet these Sikes Act and DoD guidelines, (2) support current and projected military missions, and (3) reflect up-to-date environmental conditions, was to begin management planning for each resource element anew. The Goldwater Amendment and its subplans were to be relied on as sources of management information and concepts, but not as a framework upon which a new management program could be directly built.

Third, input from the public during the development of the LEIS for the renewal of the BMGR land withdrawal and scoping for this EIS for the proposed INRMP repeatedly urged that a new range-wide management plan be prepared for the range. These comments generally reflect opinions that the Goldwater Amendment is based on old information and concepts that do not reflect the future management requirements for the BMGR.

Although the proposed INRMP will not be an update of the Goldwater Amendment, information and concepts from that earlier plan were not discarded wholesale in the NEPA process for the development of the plan. For example, three ACECs, two SRMAs, one HMA, and a backcountry byway were designated through the Goldwater Amendment. These designations collectively applied special conservation management measures to 425,620 acres of the BMGR. This EIS includes an alternative to allow these designations to expire but also includes proposals to retain or expand these special management areas. Additionally, the road network transportation planning initiated under the Goldwater Amendment has been completed through this EIS and INRMP planning process to develop a full scope of road network management alternatives that are each paired with appropriate natural resource protection measures. As indicated in Section

[29] P.L. 99-606 §3(a)(1) provided that the BMGR would be managed by the Secretary of the Interior "pursuant to the Federal Land Management Policy Act of 1976 (43 U.S.C. 1701 et seq.)." P.L. 106-65 §3031(b)(1)(a) and (b)(3)(D) provide that the range will be managed by the Secretaries of the Navy and the Air Force in accordance with an INRMP prepared and implemented in accordance with the Sikes Act.

1.6, cultural resource protection measures are supported through this EIS and the proposed INRMP through the adoption of the cultural resource management goals that were developed for the ICRMP for the BMGR.

3.2.2 Management Goals and Alternatives Development

Interrelated multi-step processes were used in the development and selection of both resource management goals for the BMGR and the management alternatives carried forward for detailed consideration in this EIS. Resource management goals were developed on both policy and resource-specific basis. The steps in the goals development process included:

- Early creation of the Core Planning Team—composed of representatives from the Marine Corps, Air Force, BLM, USFWS, and AGFD (the agency partners cooperating in the development of both the EIS and proposed INRMP)—to promote interagency coordination and collaboration in the preparation of the INRMP beginning with the development of resource management goals and alternatives. Technical support was provided to the Core Planning Team by URS Corporation and TNC. URS is an environmental planning firm contracted by the Air Force and Marine Corps to support and facilitate development of the EIS for the proposed INRMP. TNC, a non-governmental organization with expertise in biodiversity conservation and natural resource planning, was contracted by the Air Force through a cooperative agreement to identify natural community and species conservation elements and a biodiversity management framework for the BMGR for use in the development of the proposed INRMP.

- Collaborative development by the Core Planning Team of five preliminary goals that establish overarching management policy upon which resource-specific management goals could be developed. The preliminary policy goals were based on statutory guidance provided by the MLWA of 1999 and Sikes Act and regulatory guidance provided by DoD Instruction 4715.3, Air Force Instruction 32-7064, and Marine Corps Order P5090.2A.

- Collaborative development of preliminary resource-specific goals by the Core Planning Team for the management and use of resources. The resource-specific goals were based on the policy goals, applicable statutory and DoD regulatory guidance, the missions of the Core Planning Team agencies, and a review of prior goals/objectives established for the BMGR through former management plans. The former management plans considered include the 1986 Luke Air Force Range Natural Resources Management Plan prepared by the University of Arizona for the U.S. Air Force and the 1990 Lower Gila South Resource Management Plan (Goldwater Amendment) prepared by the BLM. This last step is consistent with Section 3031(b)(3)(E)(viii) of the MLWA of 1999, which supports

incorporating portions of existing plans in the proposed INRMP as appropriate. The resource-specific goals were organized into 11 individual management categories.

- Public review and comment on the scope and content of the policy and resource-specific management goals during both the August 2000 scoping period for the EIS and proposed INRMP and the public workshops. Two workshops were held to facilitate development of the goals and alternatives for the EIS and proposed INRMP. Goals were addressed during the first workshop and alternatives were addressed during both workshops.

The policy and resource-specific management goals were reviewed and revised by the Core Planning Team following the receipt of public input during the August scoping process and again following the November public workshop. Both the policy and resource-specific management goals have range-wide application. The five overarching policy goals are non-resource specific and are in support of and consistent with the military mission, protection and conservation of natural and cultural resources, and public access to the BMGR. In no implied order of importance, the five management policy goals include:

1. Maintain and enhance the natural resources to ensure that these resources are sustained in a healthy condition for compatible uses (for example, low-impact recreation) by future generations, while supporting the existing and future military purposes of the BMGR.

2. Manage cultural resources in accordance with the BMGR Integrated Cultural Resources Management Plan.

3. Provide for public access to BMGR resources for sustainable multipurpose use, consistent with the military purposes of the range (including security and safety requirements) and ecosystem sustainability.

4. Apply ecosystem management principles through a goal- and objective-driven approach that recognizes social and economic values; is adaptable to complex, changing requirements; and is realized through effective partnerships among private, local, state, tribal, and federal interests.

5. Meet or exceed the statutory requirements of the MLWA of 1999, Sikes Act, and other applicable resource management regulatory requirements.

The resource-specific goals address earth, water, vegetation, wildlife, and visual resources; transportation; recreation; Native American access; non-military and perimeter land use; and special natural/interest areas. The resource-specific based goals are presented in Table 3-1 in no implied order of importance.

TABLE 3-1
RESOURCE-SPECIFIC MANAGEMENT GOALS

Resource Management Category	Management Goal(s)
Earth Resources	▪ Implement best management practices to control and prevent excessive soil erosion, implement soil conservation measures, and restore or rehabilitate degraded landscapes wherever practicable, subject to budgetary constraints.
Water Resources	▪ Manage water resources to protect, maintain, and improve water quality; to conserve water to prevent lowering of the water table levels; and to ensure compliance with regulatory requirements while maintaining unrestricted access for military purposes.
Vegetation Resources	▪ Protect and conserve plant communities and species diversity. ▪ Identify, protect, conserve, manage, and comply with regulatory requirements for threatened and endangered plant species or otherwise important or sensitive plant species. ▪ Inventory the range for occurrence and distribution of exotic plant species and implement management measures for their removal or control. ▪ Restore or rehabilitate altered or degraded plant communities wherever practicable, subject to budgetary constraints. ▪ Incorporate the principles of ecosystem management and promote biodiversity.
Wildlife Resources	▪ Protect and conserve wildlife habitat, species diversity, and viable populations. ▪ Identify, protect, conserve, manage, and comply with regulatory requirements for federally threatened and endangered wildlife species or otherwise significant or sensitive species. ▪ Restore or rehabilitate human-altered or degraded wildlife habitats wherever practicable, subject to budgetary constraints. ▪ Incorporate the principles of ecosystem management and promote biodiversity. ▪ Control trespass livestock.
Visual Resources	▪ Protect or enhance the integrity and diversity of visual resources (including scenic qualities of the landscape) on the BMGR.
Transportation	▪ Develop a BMGR transportation plan that addresses continued land-based access to the BMGR for military training and testing; provides access for wildlife research and wildlife habitat management, land management, and law enforcement by federal and state agencies; and provides access for wildlife-oriented recreation and sustainable multipurpose use by the public. ▪ Establish policies and provide procedures that ensure that the use of vehicles on the BMGR will be controlled and directed so as to protect resources, promote safety, and minimize conflicts among the various uses of the BMGR.
Recreation	▪ Provide for public access and use of natural resources/BMGR lands for sustainable multi-purposes when such activities are compatible with mission activities and other considerations such as security, safety, and resource sensitivity. ▪ Assess the continuing applicability of SRMA designations in consideration of their incompatibility with military operations. ▪ Manage all activities in accordance with the ICRMP for the BMGR.
Native American Access	▪ Provide for Native American access to Traditional Cultural Places and sacred sites, consistent with the military mission and natural resource management goals.
Non-Military Land Use	▪ Develop a program for addressing rights-of-way on the BMGR. ▪ Participate in local initiatives to advance ecoregional planning and biodiversity goals.
Perimeter Land Use	▪ Cooperate with land managers of adjoining property for conservation, public relations, and compliance benefits. ▪ Develop strategies, in coordination with ranchers when feasible, to reduce trespass livestock occurrences.
Special Natural/Interest Areas	▪ Recognize and review existing special resource management areas, such as ACECs and the backcountry byway, and assess the continuing applicability of special management provisions for the protection of these areas.

The alternative management strategies were developed in a manner similar to that used to develop the management goals. The Core Planning Team began preliminary development of the alternatives prior to the public scoping period in August 2000. The preliminary draft of the alternative strategies was expanded and revised by the Core Team based on public input received during scoping. As already noted, revised draft management goals and the first public draft of the alternative management strategies were presented at the first public workshop in November 2000 (see Section 1.8 for a full review of the public involvement process). The second public workshop in January 2001 focused principally on advancing the process of developing management alternatives. Public comments from the workshops and resolution of the final policy and resource-specific management goals following the workshops helped to sharpen the focus on the continuing process to develop the alternative management strategies. The goals establish policy and direction for the management of resources within the BMGR. Thus the alternative management strategies scheduled for detailed study in this EIS had to prescribe actions for achieving those goals.

In addition to providing frameworks for achieving the management goals, each alternative management strategy had to be consistent with the requirements of the MLWA of 1999 and Sikes Act in order to be considered as a reasonable alternative for detailed study in this EIS. Thus, in accordance with 40 CFR §1502.14(a), each candidate alternative management strategy was assessed relative to selection criteria to ensure that it would:

- support the use of the BMGR to ensure the preparedness of the armed forces
- provide for proper management and protection of its natural and cultural resources (which is to include natural resource conservation and rehabilitation)
- provide for sustainable multipurpose public access and use of the range consistent with the requirements of its military purposes

The selection criteria are presented in Table 3-2. Alternatives that were inconsistent with these criteria were eliminated from detailed study (see Section 3.5). While the management alternatives carried forward for detailed consideration in this EIS would likely result in different levels of success at meeting the terms of the various selection criteria, each of these alternatives provides sufficient promise of success under each criterion to warrant full study.

3.3 MANAGEMENT REQUIREMENTS APPLICABLE TO ALL ALTERNATIVES

During the preparation of this EIS, certain resource management actions were identified that would be required regardless of the alternative management strategies ultimately selected as the basis for the proposed INRMP. Some of the actions identified include those that are mandated by statutory, regulatory, or administrative law. For example, all management activities must comply with the applicable provisions of federal statutes such as the Endangered Species Act and NEPA

TABLE 3-2
ALTERNATIVES SELECTION CRITERIA

Alternatives Selection Criteria	Referenced Authority/Guidance							
	MLWA of 1999	Sikes Act	Endangered Species Act	Section 110 of NHPA	DoD Instruction 4715.3	AFI 32-7064	Marine Corps Order P5090.2A	INRMP Goals
1.0 Military mission and safety—each alternative must:								
1.1 Result in no net loss in the capability of the BMGR to support the military purposes for which it was established	✓	✓			✓	✓	✓	✓
1.2 Maintain the flexibility of the range to support future military missions that may not be currently defined	✓	✓			✓	✓	✓	✓
1.3 Protect the safety of the public and military personnel	✓	✓			✓	✓	✓	✓
1.4 Maintain, improve, or restore environmental conditions that will support the military purposes of the range as well as prevent, minimize, or mitigate conflicts between military activities and environmental regulatory requirements	✓	✓			✓	✓	✓	✓
1.5 Prevent non-military land use, including public access, that would interfere with the military purposes of the range	✓	✓			✓	✓	✓	✓
1.6 Avoid discretionary natural or cultural resource management activities that would interfere with the military purposes of the range	✓	✓			✓	✓	✓	✓
2.0 Natural and cultural resources protection, conservation, and rehabilitation—each alternative must:								
2.1 Support ecosystem management and biodiversity conservation	✓	✓			✓	✓	✓	✓
2.2 Support the recovery of endangered species and the protection of other special status species	✓	✓	✓		✓	✓	✓	✓
2.3 Promote habitat and species conservation, rehabilitation, and, where appropriate, enhancement	✓	✓	✓		✓	✓	✓	✓
2.4 Control and prevent the spread of invasive species	✓	✓	✓		✓	✓	✓	✓
2.5 Control and prevent soil erosion and promote rehabilitation of degraded soils	✓	✓			✓	✓	✓	✓
2.6 Protect and enhance visual resources	✓	✓			✓	✓	✓	✓
2.7 Recognize existing special resource management areas and consider measures for the future protection and conservation of their resources	✓	✓			✓	✓	✓	✓
2.8 Support or enhance stewardship of cultural resources	✓	✓		✓	✓	✓	✓	✓
3.0 Sustainable public use—each alternative must:								
3.1 Provide for sustainable multipurpose public use of the BMGR to the extent consistent with its military purposes	✓	✓			✓	✓	✓	✓
3.2 Provide for sustainable multipurpose public use of the BMGR to the extent that the use is consistent with the needs of wildlife resources		✓						✓
3.3 Make the BMGR available to public use when access is compatible with ecosystem sustainability and consistent with public safety					✓	✓	✓	✓

or Arizona statutory requirements such as state hunting regulations and the Native Plant Law regardless of the alternative selected and implemented through the proposed INRMP. Enforcement of these and other applicable laws will occur regardless of the alternative management strategies selected.

Other actions that would be required regardless of the selected management alternative include those that are required to postpone the advent of certain activities until appropriate management policies addressing these activities can be determined in the future. For example, commercial tour operations are not known to have occurred on the BMGR and there had been no requests to authorize such activities. In the absence of any previous or ongoing requirements to regulate commercial tour activity, no policies or parameters to manage such activities have been included in the alternative management strategies for the proposed INRMP. Consequently, commercial tour operations will be prohibited within the BMGR, regardless of the alternative management strategy ultimately selected through the INRMP, until such time that a need to permit such operations is identified and appropriate regulations for managing them are developed.

The following actions were identified that would be required regardless of the alternative management strategies selected and implemented through the INRMP:

1. Comply with federal statutory requirements (such as the ESA, Clean Air Act, NHPA, Archeological Resources Protection Act [ARPA], etc.), DoD policy and guidance, NEPA, MLWA of 1999, and the Sikes Act, as well as state and local statutory requirements (such as the Native Plant Law, air and water quality standards, hunting regulations, and requiring all campsites to be more than one-quarter-mile away from water sources).

2. Enforce federal, state, and local environmental protection laws and the resource protection provisions of the INRMP.

3. Adhere to the policy and range-wide resource management goals established for the INRMP.

4. Be consistent with the provisions of MOUs, letters of agreement, conservation agreements, biological opinions, or other types of agreements or decisions developed for management or regulatory compliance purposes.

5. Incorporate the principles of ecosystem management.

6. Require that public access and use of natural resources be compatible with mission activities and other considerations such as security, safety, and resource conservation and protection goals.

7. Incorporate cultural resource protection strategies that reflect the DoD's mandate to preserve cultural resources and to include consideration of those resources in its decision-making process.

8. Comply with direction provided in the revised 36 CFR Part 800 and DoD policy, which requires agencies to initiate consultation with the State Historic Preservation Office (SHPO), tribes, and others pursuant to Section 106 of the NHPA early in the planning process, when the widest range of prudent and feasible alternatives is available and issues identified through consultation may be resolved most easily.

9. Be consistent with the ICRMP for the BMGR.

10. Prohibit commercial tour operations on the BMGR unless a range policy is developed to permit and regulate or restrict this use.

11. In accordance with Section 3031(b)(3)(E)(vi)(I) of the MLWA of 1999, develop an MOU with agencies and tribal governments responsible for lands adjacent to the BMGR to establish courses of action to be taken by the Secretaries of the Navy and Air Force to prevent, suppress, and manage brush and range fires occurring outside the boundaries of the range resulting from military activities.

3.4 DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

3.4.1 Alternative Management Strategies Matrix

Alternative Management Strategies A, B, C, and D were developed through a collaborative effort by the member agencies of the Core Planning Team and included in-depth reviews of preliminary drafts of the strategies at the two public workshops. These strategies were summarized in Section 3.1. Fully detailed descriptions of these four alternative management strategies are presented in Table 3-3 to provide a side-by-side comparison of the 17 separate resource management elements of each strategy. Briefly, Alternative Management Strategy A, the no-action alternative, represents the existing management prescriptions of the Goldwater Amendment and its attendant subplans. Alternative Management Strategy B is generally similar to Strategy A with the key exceptions that provisions under Strategy B include the potential to expand public motorized access and recreation use opportunities and to construct two new bypass roads around the northwest corner of the Cabeza Prieta NWR. Among other provisions, the key distinctions of Strategies C and D, in contrast to Strategies A and B, are progressively greater limitations on motorized vehicle access and public use opportunities and a progressively increased emphasis on the use of ecosystem management principles through the application of ecosystem monitoring and adaptive management. The Cabeza Prieta NWR bypass road would be supported under Strategy C but not under Strategy D. Strategies C and D would both direct the

conservation of blocks of unroaded land within the BMGR that are 3,000 acres or more in area to the extent that such conservation is compatible with the military mission or other agency requirements.

Each of the alternative management strategies was derived from the policy and resource-specific goals developed for the proposed INRMP. The relationships between these goals and the 17 resource management elements represented in the alternative management strategies are represented in Table 3-4. The management strategies implemented through the proposed INRMP will become management objectives for achieving those goals.

3.4.2 Proposed Action

Alternative Management Strategies A, B, C, and D, as shown in Table 3-3, represent the full range of alternatives considered in detail in this EIS for the proposed INRMP. The proposed action for the long-term management of natural and cultural resources within the BMGR combines various elements from the 17 resource management elements of each of the four strategies to form a separate composite management alternative. This fifth alternative is shown in Table 3-3 by gray highlighting that signifies the resource management strategy selected for the proposed action for each resource management element. All 17 of the resource management elements included in the strategy matrix are represented in the proposed action. Although the proposed action is defined by resource management elements selected from among those representing the other four alternatives, the proposed action represents a management composite that is unique from that of any of the other four alternatives. There are many other possible aggregate combinations of management strategies that could be examined as alternatives. The proposed action and the four alternative management strategies, however, reasonably represent the relative range of BMGR resource management possibilities that are consistent with the MLWA of 1999, Sikes Act, other applicable laws, public scoping input, and the multiple agency missions that must be performed on the range.

The proposed action strategy would be applied range-wide in 14 out of the 17 management elements represented in the strategy matrix (Table 3-5). For the other three management elements, the selected proposed action strategy differs on a management unit basis. These three management elements are:

- Recreation services and use supervision
- Rockhounding
- Wood cutting, gathering, and firewood use, and collection of native plants

TABLE 3-3
ALTERNATIVE MANAGEMENT STRATEGIES

RESOURCE MONITORING ALTERNATIVE MANAGEMENT STRATEGIES				
Resource Management Element	**Strategy A**	**Strategy B**	**Strategy C**	**Strategy D**
1. Resource Inventory and Monitoring	• Implement and continue monitoring programs established under the Lechuguilla Mohawk HMP or planned under the Draft Barry M. Goldwater East HMP for water hole dependability, wildlife population censuses, bat gate effectiveness, presence of rare and threatened/endangered plant/animal species, and ground and habitat disturbance • Implement cultural resource monitoring program as identified in the ICRMP • Establish wildlife inventories and monitoring for game and non-game species	Same as Strategy A, plus: • Develop and implement systems to monitor the effectiveness of compliance actions	Same as Strategy B, plus: • Develop and implement a limits of acceptable change system to monitor key indicators of environmental effects of ongoing military and civilian use of the BMGR • Use the findings of monitoring to develop adaptive management responses to emerging resource conservation and protection problems • Expand the monitoring system to detect trends within the BMGR ecosystem that would indicate overall biodiversity and health • Establish and conduct vegetation and wildlife surveys and monitoring for selected species and natural communities and update maps and databases as appropriate	Same as Strategy C, plus: • Specifically monitor ecological recovery and trends in locations where uses have been limited relative to locations where such activities continue • Develop the ecosystem monitoring system for the BMGR within the context of monitoring and management activities elsewhere within the greater Sonoran Desert Ecoregion
SPECIAL NATURAL/INTEREST AREAS ALTERNATIVE MANAGEMENT STRATEGIES				
Resource Management Element	**Strategy A**	**Strategy B**	**Strategy C**	**Strategy D**
2. Special Natural/Interest Areas	• Retain Mohawk Mountains and Sand Dunes, Tinajas Altas, and Gran Desierto Dunes ACECs; Yuma Desert and Sand Dunes HMA, Crater Range SRMA and the remaining portions of the Sentinel Plain SRMA; and El Camino del Diablo Backcountry Byway as special natural interest areas • Retain applicable special management provisions	• Allow existing special resource management areas (ACECs, SRMAs, and Backcountry Byway) to expire on 6 November 2001 • Redesignate flat-tailed horned lizard HMA as a special natural/interest area and retain existing management provisions • Manage former ACECs, SRMAs, and Backcountry Byway without special provisions	• Redesignate ACECs as special natural/interest areas, but allow the SRMAs and Backcountry Byway to expire • Allow for development of special management provisions as needed for resource protection • Redesignate flat-tailed horned lizard HMA as a special natural/interest area and retain existing management provisions • Evaluate the potential for altering existing or establishing additional special natural/interest areas based at least in part on the natural communities and plant and wildlife species that are identified as conservation elements for the BMGR or to better manage special geologic, scenic, cultural or other resource areas	• Redesignate ACECs, SRMAs, and the Backcountry Byway as special natural/interest areas • Allow for development of special management provisions as needed for resource protection • Redesignate flat-tailed horned lizard HMA as a special natural/interest area and retain existing management provisions • Evaluate the potential for altering existing or establishing additional special natural/interest areas based at least in part on the natural communities and plant and wildlife species that are identified as conservation elements for the BMGR or to better manage special geologic, scenic, cultural or other resource areas

= Proposed Actions

TABLE 3-3
ALTERNATIVE MANAGEMENT STRATEGIES

MOTORIZED ACCESS AND VISITOR CAMPING ALTERNATIVE MANAGEMENT STRATEGIES				
Resource Management Elements	**Strategy A**	**Strategy B**	**Strategy C**	**Strategy D**
3. Motorized Access and Unroaded Area Management	• Retain entire existing road network (see Figures 3-1 and 3-2) • Minimize new road construction by coordinating access needs and avoiding conflicts and replication in road use • Develop a transportation plan to facilitate effective management of an appropriate road system with a provision to close roads not meeting land management, public, or military needs	• Retain entire existing road network (see Figures 3-1 and 3-2) • Close selected roads to public access where an agency mission or resource protection issues conflict with public use • Retain existing level of motorized public access unless a compliance issue arises • Allow future motorized public access to currently restricted locations if changes in military activities eliminate safety or security restrictions in those locations • Evaluate the foreseeable need for and generalized effect of developing additional roads for motorized public or agency use in general terms; proposals for construction of such roads would be reviewed in detail in accordance with NEPA and other regulatory requirements on a case-by-case and site-specific basis • Implement site specific planning for two bypass roads that would reroute vehicle traffic around rather than through the northwest corner of the Cabeza Prieta NWR	• Retain the majority of existing motorized access unless a compliance or resource conservation issue arises (see Figures 3-1 and 3-2) • Close selected roads to public access where an agency mission or resource protection issues conflict with public use • Restrict access on redundant roads in localized areas • Allow future motorized public access to currently restricted locations if changes in military activities eliminate safety or security restrictions in those locations • Evaluate the foreseeable need for and generalized effect of developing additional roads for agency purposes in general terms; proposals for construction of such roads would be reviewed in detail in accordance with NEPA and other regulatory requirements on a case-by-case and site-specific basis • Implement site specific planning for two bypass roads that would reroute vehicle traffic around rather than through the northwest corner of the Cabeza Prieta NWR • Evaluate allowing public use of new roads developed for general agency purposes • Conserve existing unroaded areas of 3,000 acres or more to the extent they are compatible with military or agency missions	• Limit motorized public access to those roads that are also necessary for military mission or other specific agency requirements (see Figures 3-1 and 3-2) • Close selected roads to public access where an agency mission or resource protection issues conflict with public use • Close roads not meeting military or agency needs • Allow future motorized public access to currently restricted locations if changes in military activities eliminate safety or security restrictions in those locations • Evaluate the foreseeable need for and generalized effect of developing additional roads for agency purposes in general terms; proposals for construction of such roads would be reviewed in detail in accordance with NEPA and other regulatory requirements on a case-by-case and site-specific basis • Prohibit development of new public use roads • Implement increased public education and enforcement measures, including public education on the natural and cultural resource values of unroaded areas • Maintain existing blocks of unroaded areas of 3,000 acres or more to the extent they are compatible with military or agency requirements • Restore closed roads where feasible and prudent to remediate a degraded ecological process or enhance wildlife usage
4. Camping and Visitor Stay Limits	• Allow dispersed self-contained (i.e., non-vehicle-based, such as backpacking) camping in all areas open to the public • Allow vehicle-based camping within 50 feet of existing roads designated as open to public use • Limit vehicle-based camping stays to 14 consecutive days within a 28-day period	• Allow dispersed self-contained camping in all areas open to the public • Allow vehicle-based camping within 100 feet of existing roads designated as open to public use • Limit vehicle-based camping stays to 14 consecutive days within a 28-day period except by special use permit • Define and prescribe reasonable rules for the disposal of human sewage and solid waste in accordance with applicable federal, state, and local regulations	• Allow dispersed self-contained camping in all areas open to the public • Allow vehicle-based camping within 50 feet of most existing roads designated as open to public use; restrict camping along certain road segments for resource protection purposes • Assess benefits and effects of establishing designated camping areas and implement a decision based on the findings • Limit vehicle-based camping stays to 14 consecutive days within a 28-day period except by special use permit • Require all campsites to be more than ¼-mile away from designated natural and cultural resources that are sensitive to impacts arising from human-induced disturbances • Define and prescribe reasonable rules for the disposal of human sewage and solid waste in accordance with applicable federal, state, and local regulations	• Allow dispersed self-contained camping in all areas open to the public • Allow vehicle-based camping within 50 feet of most existing roads designated as open to public use; restrict camping along certain road segments for resource protection purposes • Assess benefits and effects of establishing designated camping areas and implement a decision based on the findings • Limit vehicle-based camping stays to 7 consecutive days within a 28-day period except by special use permit • Require all campsites to be more than ¼-mile away from designated natural and cultural resources that are sensitive to impacts arising from human-induced disturbances • Define and prescribe reasonable rules for the disposal of human sewage and solid waste in accordance with applicable federal, state, and local regulations

	= Proposed Actions

TABLE 3-3
ALTERNATIVE MANAGEMENT STRATEGIES

PUBLIC USE ALTERNATIVE MANAGEMENT STRATEGIES				
Resource Management Elements	**Strategy A**	**Strategy B**	**Strategy C (Unit 2)**	**Strategy D (Units 1, 3, 4, 5, 6, 7)**
5. Recreation Services and Use Supervision	• Prohibit public off-road vehicle travel • Prohibit on- and off-road racing • Allow motorized public travel in dry streambeds and wash bottoms in accordance with the Draft Barry M. Goldwater East HMP • Require a special use permit for a single party with 50 or more vehicles • Require compliance with general vehicle operating rules, which include requiring all vehicles and operators to be licensed for highway driving under Arizona laws and regulations and prohibiting the operation of vehicles in a manner that is reckless, careless, negligent, or likely to cause damage to natural or cultural resources • Retain existing permit system • Issue special recreation use permits, as appropriate • Provide the public with up-to-date visitor use maps and rules and regulations • Establish an environmental education program • Enforce all public access permit requirements and regulations • Develop an action plan for interagency law enforcement • Develop a BMGR sign plan, implement a signing program based on identified sign needs • Implement appropriate public safety protection measures	• Evaluate the need for and effects of allowing public off-road vehicle travel in designated areas • Prohibit on- and off-road racing • Allow motorized public travel in designated washes, when dry • Require a special use permit for a single party with 30 or more vehicles • Require compliance with general vehicle operating rules, which include requiring all vehicles and operators to be licensed for highway driving under Arizona laws and regulations and prohibiting the operation of vehicles in a manner that is reckless, careless, negligent, or likely to cause damage to natural or cultural resources • Retain a permit system, but implement measures to make the permits easier to obtain • Issue special recreation use permits, as appropriate • Retain existing public education and recreation use information programs which includes BMGR ecology and natural and cultural resource protection information programs • Retain a minimum of two full-time law enforcement positions dedicated to the BMGR • Retain existing levels of resource protection law enforcement unless a compliance issue arises • Retain existing interpretation and signs unless there is a public safety issue • Retain existing gates and fences unless additional gates and fencing are needed for safety or compliance reasons • Evaluate the feasibility of allowing public entry to mines where such use is compatible with safety and resource protection requirements; if feasible, implement a program for such use under special use permit provisions	• Prohibit public off-road vehicle travel • Prohibit on- and off-road racing • Restrict motorized public travel in all washes, except where the wash is a designated part of the road system open to the public and is dry • Require a special use permit for a single party with 20 or more vehicles • Require compliance with general vehicle operating rules, which include requiring all vehicles and operators to be licensed for highway driving under Arizona laws and regulations and prohibiting the operation of vehicles in a manner that is reckless, careless, negligent, or likely to cause damage to natural or cultural resources • Retain a permit system and expand efforts to educate users about natural and cultural resource sensitivities • Issue special access/use permits, as appropriate • Implement increased public education and recreation use information programs, particularly to inform the public about road restrictions and resource sensitivities • Retain a minimum of four full-time law enforcement positions dedicated to the BMGR • Develop and implement limits-of-acceptable change monitoring to guide recreation use management and protect natural and cultural resources • Assess requirements for signs or other measures to indicate road restrictions; implement management actions based on findings • Assess the need for and effects of additional gates and fencing to control entry and use; erect as needed • Develop and maintain recreation use records and statistics • Prohibit use of metal detectors • Prohibit entry to mines	• Prohibit public off-road vehicle travel • Prohibit on- and off-road racing • Restrict motorized public travel in all washes, except where the wash is a designated part of the road system open to the public and is dry • Require a special use permit for a single party with 10 or more vehicles • Require compliance with general vehicle operating rules, which include requiring all vehicles and operators to be licensed for highway driving under Arizona laws and regulations and prohibiting the operation of vehicles in a manner that is reckless, careless, negligent, or likely to cause damage to natural or cultural resources • Retain a permit system and expand efforts to educate users about natural and cultural resource sensitivities • Issue special access/use permits, as appropriate • Implement increased public education and recreation use information programs, particularly to inform the public about road restrictions and resource sensitivities • Retain a minimum of six full-time law enforcement positions dedicated to the BMGR • Develop and implement limits-of-acceptable change monitoring to guide recreation use management and protect natural and cultural resources • Assess requirements for signs or other measures to indicate road restrictions; implement management actions based on findings • Assess the need for and effects of additional gates and fencing to control entry and use; erect as needed • Develop and maintain recreation use records and statistics • Prohibit use of metal detectors • Prohibit entry to mines
			(Units 2, 3)	**(Units 1, 4, 5, 6, 7)**
6. Rockhounding (Surface Removal Only)	• Surface rock removal limited to 24 pounds plus one piece	• Limit rock removal to no more than 25 pounds • Allow surface rockhounding (i.e., no subsurface excavation) for personal (i.e., non-commercial) purposes to occur in any location open to the public as long as no compliance issue arises	• Limit rock removal to no more than 25 pounds • Restrict surface rockhounding for personal (i.e., non-commercial) purposes from special natural/interest and other designated natural and cultural resource areas that are sensitive to impacts arising from human-induced disturbances	• Prohibit rockhounding

= Proposed Actions

TABLE 3-3
ALTERNATIVE MANAGEMENT STRATEGIES

PUBLIC USE ALTERNATIVE MANAGEMENT STRATEGIES (Continued)				
Resource Management Elements	**Strategy A**	**Strategy B**	**Strategy C (Units 2, 3, 4, 5, 6, 7)**	**Strategy D (Unit 1)**
7. Wood Cutting, Gathering, and Firewood Use, and Collection of Native Plants	▪ Prohibit woodcutting or wood collection for commercial or domestic use ▪ Permit campfires using dead and downed wood ▪ Prohibit collection of firewood in redesignated ACECs and other special natural/interest areas ▪ Prohibit the collection or salvage of native plants on the BMGR (including plant parts, seeds, or fruit) listed in the Arizona Native Plant Law except in cases where the plants are being salvaged prior to disturbance or for protected Native American purposes; conduct such salvage efforts in compliance with the Arizona Native Plant Law and with appropriate level of coordination with the Arizona Department of Agriculture	▪ Allow for wood cutting, gathering, and firewood use as long as wood is used at a sustainable rate and no regulatory compliance issue arises ▪ Prohibit removal of wood from the range ▪ Prohibit the collection or salvage of native plants on the BMGR (including plant parts, seeds, or fruit) except in cases approved by the range manager where the plants are being salvaged prior to disturbance or for protected Native American purposes or for scientific purposes; conduct such salvage efforts in compliance with the Arizona Native Plant Law and with appropriate level of coordination with the Arizona Department of Agriculture	▪ Allow using dead and downed wood for campfires ▪ Prohibit all other forms of wood cutting or wood collection ▪ Prohibit removal of wood from the range ▪ Monitor native wood supplies in high-use areas; restrict wood collection if resource conditions dictate ▪ Prohibit the collection or salvage of native plants on the BMGR (including plant parts, seeds, or fruit) except in cases approved by the range manager where the plants are being salvaged prior to disturbance or for protected Native American purposes or for scientific purposes; conduct such salvage efforts in compliance with the Arizona Native Plant Law and with appropriate level of coordination with the Arizona Department of Agriculture	▪ Prohibit wood cutting, and wood gathering, prohibit native wood campfires ▪ Prohibit removal of wood from the range ▪ Prohibit the collection or salvage of native plants on the BMGR (including plant parts, seeds, or fruit) except in cases approved by the range manager where the plants are being salvaged prior to disturbance or for protected Native American purposes or for scientific purposes; conduct such salvage efforts in compliance with the Arizona Native Plant Law and with appropriate level of coordination with the Arizona Department of Agriculture
8. Hunting	▪ Continue existing game management programs	▪ Continue existing game management programs ▪ Assess the need for a special hunting permit program that requires payment of nominal fees to be used for the protection, conservation, and management of wildlife, including habitat improvement and related activities on the BMGR; implement/manage actions as indicated by the assessment results ▪ Evaluate the effects of non-game species collection on wildlife, habitat, and other resources and, if indicated, limit or restrict collection activities within the authority of state law	Same as Strategy B	▪ Continue existing game management programs ▪ Assess the need for a special hunting permit program that requires payment of nominal fees to be used for the protection, conservation, and management of wildlife, including habitat improvement and related activities on the BMGR; implement/manage actions as indicated by the assessment results ▪ Petition the Arizona Game and Fish Commission to close the BMGR to non-game species collection
9. Recreational Shooting	▪ Allow recreational shooting to occur under existing regulations as long as it is compatible with military use and there is no public safety issue	▪ Allow recreational shooting to occur under existing regulations as long as it is compatible with military use, public safety, and no significant resource issues are identified	Same as Strategy B plus: ▪ Assess importance and character of recreational shooting as an activity/issue to determine the appropriateness of this activity on the BMGR and implement a decision based on the findings ▪ Prohibit automatic weapons, except with special use permit ▪ Consider designating specific shooting area(s) ▪ Prohibit recreational shooting between sunset and sunrise, except with special use permit	▪ Prohibit recreational shooting activities (not to include hunting), and assess appropriateness of allowing this activity in designated areas

UTILITY AND TRANSPORTATION CORRIDOR ALTERNATIVE MANAGEMENT STRATEGIES				
Resource Management Element	**Strategy A**	**Strategy B**	**Strategy C**	**Strategy D**
10. Utility/Transportation Corridors	▪ Restrict construction of non-military overhead transmission lines to alignments immediately parallel to the existing Gila Bend to Ajo transmission line and non-military underground facilities to the west side of and parallel to the Tucson Cornelia and Gila Bend Railroad ▪ Require appropriate field examinations and/or environmental assessments for utility/transportation corridor proposals	▪ Evaluate proposals to develop additional utility/ transportation corridors on a case-by-case basis ▪ Establish a protocol consistent with NEPA and other regulatory requirements for reviewing/approving proposed actions related to transportation and utility corridors	▪ Restrict all future utility/ transportation corridor development to existing corridors, except for applications filed prior to 6 November 2001, which would include the Yuma Area Service Highway ▪ Establish a protocol consistent with NEPA and other regulatory requirements for reviewing/approving proposed actions within existing corridors ▪ Restrict construction of overhead transmission lines to alignments immediately parallel to the existing Gila Bend to Ajo transmission line and non-military underground facilities to the west side of and parallel to the Tucson Cornelia and Gila Bend Railroad	▪ Restrict all future utility/transportation corridor development to existing corridors ▪ Establish a protocol consistent with NEPA and other regulatory requirements for reviewing/approving proposed actions within existing corridors ▪ Restrict construction of overhead transmission lines to alignments immediately parallel to the existing Gila Bend to Ajo transmission line and non-military underground facilities to the west side of and parallel to the Tucson Cornelia and Gila Bend Railroad

= Proposed Actions

TABLE 3-3
ALTERNATIVE MANAGEMENT STRATEGIES

VEGETATION AND WILDLIFE ALTERNATIVE MANAGEMENT STRATEGIES				
Resource Management Element	**Strategy A**	**Strategy B**	**Strategy C**	**Strategy D**
11. General Vegetation, Wildlife, Wildlife Habitat, and Wildlife Waters	• Evaluate the cumulative impacts of land disturbance on wildlife habitat in order to establish criteria for protection of important habitat • Update vegetation map with newly gathered botanical information • Develop procedures to control all trespass livestock • Implement the habitat management activities prescribed by the Lechuguilla-Mohawk HMP • Finalize and implement the habitat management activities prescribed by the Barry M. Goldwater East HMP • Implement the wildlife water developments prescribed by the Lechuguilla-Mohawk and Draft Barry M. Goldwater East HMPs. This includes the construction of up to two new waters (seven were planned, five have been constructed) plus the repair, redesign, and/or redevelopment of three existing wildlife waters within BMGR—West and the development of 15 new waters and the repair, redesign, and/or redevelopment of 13 existing waters within BMGR—East	• Evaluate the cumulative impacts of land disturbance on wildlife habitat in order to establish criteria for protection of important habitat • Update vegetation map with newly gathered botanical information • Develop procedures to control all trespass livestock • Conduct surveys for, establish control priorities for, prevent the introduction of, and monitor populations of invasive species and develop coordinated strategies to locally eradicate and/or control the spread of these species commensurate with the threats they pose to natural resources on the BMGR and within the greater Sonoran Desert Ecoregion • Implement vegetation and wildlife habitat restoration efforts for areas that have been damaged by a discontinued military, agency, or intensive public use • Implement the wildlife water developments prescribed by the Lechuguilla-Mohawk and Draft Barry M. Goldwater East HMPs • Consider implementation of additional wildlife water developments • Allow for the maintenance and repair of existing water developments	• Evaluate the cumulative impacts of land disturbance on wildlife habitat in order to establish criteria for protection of important habitat • Update vegetation map with newly gathered botanical information • Develop procedures to control all trespass livestock • Conduct surveys for, establish control priorities for, prevent the introduction of, and monitor populations of invasive species and develop coordinated strategies to locally eradicate and/or control the spread of these species commensurate with the threats they pose to natural resources on the BMGR and within the greater Sonoran Desert Ecoregion • Identify key areas (e.g., pronghorn concentration areas, fawning grounds, wildlife corridors) and implement restrictions on activities as needed to protect and conserve habitat, ecosystems, and biodiversity • Implement vegetation and wildlife habitat restoration efforts for areas that have been damaged by a discontinued military, agency, or intensive public use • Implement up to six high priority wildlife water developments projects prescribed by the Lechuguilla-Mohawk and Draft Barry M. Goldwater East HMPs during the first five years of the INRMP • Conduct a thorough review of literature and implement studies in the first five years of the INRMP to determine benefits and adverse effects of wildlife waters with the intent of providing information to be used in determining the value of developing, maintaining, or removing water developments • Continue wildlife water research as needed after the first five years of the INRMP • Establish a panel of experts to review available data and make recommendations to the respective installation commanders by the first five-year review regarding whether sufficient evidence exists to suspend planned water developments, remove existing developments, or add new developments • In the first five years of the INRMP, allow for the maintenance and repair of existing water developments; future maintenance and repair decisions would be pending the findings of the five-year review panel	• Evaluate the cumulative impacts of land disturbance on wildlife habitat in order to establish criteria for protection of important habitat • Update vegetation map with newly gathered botanical information • Develop procedures to control all trespass livestock • Conduct surveys for, establish control priorities for, prevent the introduction of, and monitor populations of invasive species and develop coordinated strategies to locally eradicate and/or control the spread of these species commensurate with the threats they pose to natural resources on the BMGR and within the greater Sonoran Desert Ecoregion • Identify key areas (e.g., pronghorn concentration areas, fawning grounds, wildlife corridors) and implement restrictions on activities as needed to protect and conserve habitat, ecosystems, and biodiversity • Implement vegetation and wildlife habitat restoration efforts for areas that have been damaged by a discontinued military, agency, or intensive public use • Suspend implementation of wildlife water developments for the first five years of the INRMP, unless waters are implemented for scientific purposes • Conduct a thorough review of literature and implement studies in the first five years of the INRMP to determine benefits and adverse effects of wildlife waters with the intent of providing information to be used in determining the value of developing, maintaining, or removing water developments • Continue wildlife water research as needed after the five years of the INRMP • Establish a panel of experts to review available data and make recommendations to the respective installation commanders by the first five-year review regarding whether to continue suspension of wildlife water developments, remove existing waters, or add new developments • Allow for the maintenance and repair of existing water developments pending the findings of the five-year review panel
12. Special Status Species	• Authorize predator control if necessary to protect an endangered species • Support continued Sonoran pronghorn monitoring and recovery efforts • Avoid new surface disturbing activities within six miles of permanent water sources and within the range of the Sonoran pronghorn • Inventory, categorize and manage desert tortoise consistent with Desert Tortoise Habitat Management on the Public Lands: A Rangewide Plan	• Meet all existing and future compliance requirements for the protection and conservation of special status species, including all mandatory provisions of existing and future biological opinions, conservation agreements, etc. • Conduct surveys for special status species on an as-needed basis • Maintain an updated list of special status species that potentially occur on the BMGR • Implement habitat improvements in support of endangered species recovery plans	• Same as Strategy B, plus: • Provide resources, as necessary, for predator control to protect a special status species • Initiate and/or continue surveys to determine the distribution and abundance for special status species (i.e., the Acuña cacti) in appropriate habitat areas	Same as Strategy C

= Proposed Actions

TABLE 3-3
ALTERNATIVE MANAGEMENT STRATEGIES

SOIL, WATER, AIR, VISUAL, AND WILDFIRE RESOURCE ALTERNATIVE MANAGEMENT STRATEGIES				
Resource Management Element	**Strategy A**	**Strategy B**	**Strategy C**	**Strategy D**
13. Soil and Water Resources	• Restrict the operation of motorized vehicles and heavy equipment to established roads and previously impacted areas, except when related to a specific permitted project • Assess project site soils for their vulnerability to soil disruption and subsequent wind and water erosion; take measures to minimize soil disturbances • Update soils map as data are collected during site evaluations • Use specific techniques to minimize soil disturbance on previously unimpacted soils • Keep groundwater development and exploration to a minimum in ACECs and other environmentally sensitive areas • Monitor water table levels	Same as Strategy A, plus: • Restrict or modify activities as necessary to comply with statutory requirements for soil and water resources and to prevent erosion in areas of cultural resource sensitivity	Same as Strategy B, plus: • Take measures to minimize soil/water contamination or erosion resulting from vehicle use or other activities	Same as Strategy C, plus: • Conduct a range-wide soil survey using Natural Resource Conservation Service (NRCS) standards to provide baseline information on soil types, erosion risks, and suitability for various activities • Temporarily restrict vehicular and construction activities when soils are susceptible to a heightened risk of erosion, such as following heavy rain or during periods of extended drought when road surfaces are like powder • Restore areas where vehicle use has caused excessive surface damage, temporarily closing roads if necessary
14. Air Resources	• Control excessive fugitive dust at permitted construction sites and recreation activity areas • Develop Best Management Practices for activities with potential for generating non-point source pollution	No special management objectives	• Use dust palliatives to control excessive fugitive dust generated on heavily traveled roads and construction sites and evaluate the environmental impacts of the control measures	Same as Strategy C, plus: • Monitor air quality trends and avoid new activity in areas of deteriorated air quality
15. Visual Resources	• Protect mountain vistas from visual intrusion • Lessen, prevent, or mitigate further degradation of visual resources • Use already disturbed and impacted land areas • Establish visual resource management classes for the BMGR	Same as Strategy A, plus: • Assess the effects of new actions on visual resources as required by regulatory compliance processes and implement needed management or mitigation actions	Same as Strategy B, plus: • Review, revise as needed, and adopt interim visual resource management (VRM) classification for the BMGR as developed in the renewal of the range land withdrawal • Apply VRM criteria to new projects	Same as Strategy C, plus: • Restrict non-military activities that would further deteriorate visual resource qualities within or visible from unroaded areas and avoid such impacts as a result of military actions to the extent compatible with the military mission • Restore visual resource impacts within or visible from unroaded areas to the extent compatible with the military mission
16. Wildfire Management	• Suppress wildfires with the lowest acreage loss and in the most cost-effective and efficient manner	• Develop a range-wide fire management plan based on the indications of the best known science and management practices that establishes fire prevention, suppression, recovery, mapping, monitoring, and possible mitigation protocols for both human and non-human caused fires in accordance with the threat to human life, property, and natural and cultural resources	Same as Strategy B	Same as Strategy C

= Proposed Actions

TABLE 3-3
ALTERNATIVE MANAGEMENT STRATEGIES

PERIMETER LAND USE MANAGEMENTAND REGIONAL PLANNING ALTERNATIVE MANAGEMENT STRATEGIES				
Resource Management Element	**Strategy A**	**Strategy B**	**Strategy C**	**Strategy D**
17. Perimeter Land Use, Encroachment, and Regional Planning	**No special management objectives**	• Assess the implications of adjacent land use plans and changes for natural and cultural resources management on the BMGR as these plans are published or changes implemented • Develop and implement management responses to adjacent land use plans and changes as necessary to protect and conserve BMGR natural and cultural resources • Interact with off-range land owners and/or managers as necessary to change or mitigate land use plans or activities that have negative or potentially negative effects on BMGR resources	Same as Strategy B, plus: • Monitor land use changes in perimeter areas • Monitor the quantity of livestock permitted on perimeter grazing allotments and maintain a list of names, addresses, and brands of permitees to be able to respond to trespass grazing • Monitor illegal immigration to anticipate how BMGR resources may be affected • Participate as a stakeholder in local and regional land-use planning processes to ensure the potential for adverse consequences to the BMGR's management of natural and cultural resources is avoided or minimized. • Coordinate with other federal agencies on conservation matters of national or regional scope • Identify, participate in, and promote the establishment of regional ecosystem management efforts	Same as Strategy C, plus: • Work with county agricultural extension agents to determine the extent and danger of pesticide drift into the BMGR and any associated soil or water quality issues • Monitor all geophysical and legal aspects of groundwater management for any potential changes that may impact BMGR natural resources • Determine the extent to which BMGR resources are interrelated or dependant on off-range resources • Identify threats to off-range resources that may negatively affect BMGR resources • Participate in opportunities to coordinate management activities with adjoining property owners when beneficial the management of natural resources

= Proposed Actions

TABLE 3-4
RELATIONSHIP OF ALTERNATIVE MANAGEMENT STRATEGIES TO RESOURCE MANAGEMENT GOALS

Resource Management Goal Category (see Table 3-1)	Resource Management Element(s) (see Table 3-3) That Address Each Goal Category	Alternative Management Strategies That Support Each Management Goal Category			
		A	B	C	D
Earth Resources	• Resource Inventory and Monitoring			✓	✓
	• Special Natural/Interest Areas	✓		✓	
	• Motorized Access and Unroaded Area Management	✓	✓	✓	✓
	• Camping and Visitor Stay Limits	✓	✓	✓	✓
	• Recreation Services and Use Supervision	✓	✓	✓	✓
	• Rockhounding	✓	✓	✓	✓
	• Utility/Transportation Corridors	✓	✓	✓	✓
	• Soil and Water Resources	✓	✓	✓	✓
Water Resources	• Resource Inventory and Monitoring	✓	✓	✓	✓
	• Motorized Access and Unroaded Area Management	✓	✓	✓	✓
	• General Vegetation, Wildlife, Wildlife Habitat, and Wildlife Waters	✓	✓	✓	✓
	• Soil and Water Resources	✓	✓	✓	✓
	• Special Status Species	✓	✓	✓	✓
Vegetation Resources	• Resource Inventory and Monitoring	✓	✓	✓	✓
	• Special Natural/Interest Areas			✓	✓
	• Motorized Access and Unroaded Area Management	✓	✓	✓	✓
	• Camping and Visitor Stay Limits			✓	✓
	• Recreation Services and Use Supervision	✓	✓	✓	✓
	• Wood Cutting, Gathering, and Firewood Use, and Collection of Native Plants	✓	✓	✓	✓
	• General Vegetation, Wildlife, Wildlife Habitat, and Wildlife Waters	✓	✓	✓	✓
	• Wildfire Management	✓	✓	✓	✓
	• Perimeter Land Use, Encroachment, and Regional Planning		✓	✓	✓
	• Special Status Species		✓	✓	✓

TABLE 3-4
RELATIONSHIP OF ALTERNATIVE MANAGEMENT STRATEGIES TO RESOURCE MANAGEMENT GOALS

Resource Management Goal Category (see Table 3-1)	Resource Management Element(s) (see Table 3-3) That Address Each Goal Category	Alternative Management Strategies That Support Each Management Goal Category			
		A	B	C	D
Wildlife Resources	• Resource Inventory and Monitoring	✓	✓	✓	✓
	• Special Natural/Interest Areas	✓	✓	✓	✓
	• Motorized Access and Unroaded Area Management	✓	✓	✓	✓
	• Camping and Visitor Stay Limits			✓	✓
	• Recreation Services and Use Supervision	✓	✓	✓	✓
	• Rockhounding			✓	
	• Hunting	✓	✓	✓	✓
	• General Vegetation, Wildlife, Wildlife Habitat, and Wildlife Waters	✓	✓	✓	✓
	• Special Status Species	✓	✓	✓	✓
	• Wildfire Management		✓	✓	✓
	• Perimeter Land Use, Encroachment, and Regional Planning		✓	✓	✓
Visual Resources	• Special Natural/Interest Areas	✓	✓	✓	✓
	• Motorized Access and Unroaded Area Management	✓		✓	✓
	• Recreation Services and Use Supervision			✓	✓
	• Utility/Transportation Corridors	✓	✓	✓	✓
	• Visual Resources	✓	✓	✓	✓
Transportation	• Special Natural/Interest Areas	✓	✓	✓	✓
	• Motorized Access and Unroaded Area Management	✓	✓	✓	✓
	• Camping and Visitor Stay Limits	✓	✓	✓	✓
	• Recreation Services and Use Supervision	✓	✓	✓	✓
	• Utility/Transportation Corridors	✓	✓	✓	✓
	• Visual Resources				✓
Recreation	• Resource Inventory and Monitoring			✓	✓
	• Special Natural/Interest Areas	✓	✓	✓	✓
	• Motorized Access and Unroaded Area Management	✓	✓	✓	✓
	• Camping and Visitor Stay Limits	✓	✓	✓	✓
	• Recreation Services and Use Supervision	✓	✓	✓	✓
	• Rockhounding	✓	✓	✓	✓
	• Wood Cutting, Gathering, and Firewood Use, and Collection of Native Plants	✓	✓	✓	✓
	• Hunting	✓	✓	✓	✓
	• Recreational Shooting	✓	✓	✓	✓

TABLE 3-4
RELATIONSHIP OF ALTERNATIVE MANAGEMENT STRATEGIES TO RESOURCE MANAGEMENT GOALS

Resource Management Goal Category (see Table 3-1)	Resource Management Element(s) (see Table 3-3) That Address Each Goal Category	Alternative Management Strategies That Support Each Management Goal Category			
		A	B	C	D
Native American Access	• Recreation Services and Use Supervision	✓	✓	✓	✓
Non-Military Land Use	• Utility/Transportation Corridors		✓	✓	✓
	• Perimeter Land Use, Encroachment, and Regional Planning		✓	✓	✓
Perimeter Land Use	• Perimeter Land Use, Encroachment, and Regional Planning		✓	✓	✓
Special Natural/Interest Areas	• Special Natural/Interest Areas	✓		✓	✓
	• Wood Cutting, Gathering, and Firewood Use, and Collection of Native Plants	✓		✓	✓

TABLE 3-5
PROPOSED ACTION
SELECTED RESOURCE MANAGEMENT STRATEGY ELEMENTS

Resource Management Elements		Selected Resource Management Strategy							
		Range-wide Application	Management Unit Specific Application						
			Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7
1.	Resource Monitoring	D							
2.	Special Natural/Interest Areas	C							
3.	Motorized Access and Unroaded Area Management	C							
4.	Camping and Visitor Stay Limits	C							
5.	Recreation Services and Use Supervision		D	C	D	D	D	D	D
6.	Rockhounding		D	C	C	D	D	D	D
7.	Wood Cutting, Gathering, and Firewood Use, and Collection of Native Plants		D	C	C	C	C	C	C
8.	Hunting	B							
9.	Recreational Shooting	C							
10.	Utility/Transportation Corridors	C							
11.	General Vegetation, Wildlife, Wildlife Habitat, and Wildlife Waters	C							
12.	Special Status Species	C							
13.	Soil and Water Resources	D							
14.	Air Resources	A							
15.	Visual Resources	B							
16.	Wildfire Management	B							
17.	Perimeter Land Use, Encroachment, and Regional Planning	D							

The resource management strategies identified for the proposed action for range-wide and unit-specific application were selected in consideration of a number of factors including:

- Resource management goals
- Quality and quantity of resources present within each management unit and across the range
- BMGR resource management history and heritage
- Resource impact threats
- Road network
- Public use patterns
- Public input

Resource management goals were key drivers in the selection of all of the proposed action strategies. For example, the incorporation of ecosystem management principles and promotion of biodiversity conservation is one of the five wildlife resource management goals identified for the range (see Table 3-1). Towards this end, Management Strategy C was selected as the proposed action for the range-wide management of vegetation, wildlife, wildlife habitat, and wildlife waters because this strategy offers greater recognition of and emphasis on the need for ecosystem and biodiversity monitoring and adaptive management than the existing management approach under the no-action alternative (see Table 3-3).

Selection of the management strategies that would be applied on a unit-specific basis considered, in particular, the quality and quantity of resources present within each management unit and across the range as well as the history and heritage of resource management and use on the BMGR. Wood cutting and gathering for firewood use is principally an issue in management units where public recreation is permissible. These areas include the southeastern portion of Unit 1, all of Unit 2, nearly all of Units 3 and 6, and the small Bender Springs area located in the northeast portion of Unit 7. Strategy D was selected as the proposed action for the management of firewood use in Unit 1 because the portion of this unit that is open to public recreation is located within the Tinajas Altas ACEC where the collection of native wood for campfires has been prohibited under the Goldwater Amendment since 1990. Strategy C was selected as the proposed wood management action for Units 2 through 7 because firewood use in these units has been traditionally allowed, no ongoing threats to native wood resources have been identified in these locations, and this strategy includes a monitoring component to protect against an unsustainable increase in firewood collection.

Resource management history and heritage were also important factors influencing the selection of Strategy C as the proposed action for the range-wide management of special natural/interest areas. This strategy would continue to recognize the resource conservation importance of the three existing ACECs, which are in turn legacies of former State Natural Areas that were established in 1982.

All of the aforementioned factors had important influences on the range-wide selection of Strategy C to manage motorized access and unroaded areas. Strategy C was identified as the proposed action for managing the road network and unroaded areas within the range because it was believed to offer the best balance between (1) requirements to provide a road network that would support the surface transportation needs of military and other agency missions and access for sustainable public use, and (2) the need to protect, conserve, and rehabilitate natural and cultural resources. In Management Units 1, 2, 3, and 6, where most of the opportunities for public access to the BMGR are available, this strategy provides for sustainable public access and resource protection requirements. The proliferation of roads as a result of public recreation has been identified as a resource impact threat in some locations, such as in the popular Fortuna Mine and the Tinajas Altas areas. Management Units 4, 5, and 7 are entirely or nearly entirely off limits to general public access. In these locations, Strategy C would provide the surface access necessary to support ongoing military and nonmilitary agency missions as well as some reserve flexibility for potential future activities.

The process of selecting the proposed action involved extensive deliberations by the Core Planning Team, which carefully considered the public input received during scoping and the two workshops. The Core Planning Team members also reviewed the requirements of their own agencies and of other agencies with important missions on the BMGR in assessing the relative merits of the alternative management strategies. The team reached consensus on the most appropriate proposed action strategy for each of the 17 management elements for which strategies were being selected.

The provisions of the proposed action are described in detail in Table 3-3 with the exception of the various public and government use road networks that would be retained or developed under the Motorized Access and Unroaded Area Management element. Descriptions of these alternative road networks are provided in Section 3.4.4.

3.4.3 Alternative Actions Including the No-action Alternative

Alternative Management Strategies A, B, C, and D, as presented in Table 3-3, represent the alternatives to the proposed action that are assessed in detail in this EIS. In contrast to the proposed action, these alternative management strategies do not combine elements from each of the four strategies. Instead, the 17 management elements listed for Strategy A make up Strategy A, the 17 management elements listed under column B make up Strategy B, etc.

Under Management Strategy A, the no-action alternative, the Air Force and Marine Corps would adopt the management provisions of the 1990 Goldwater Amendment, 1997 Lechuguilla-Mohawk HMP, 1999 Draft Barry M. Goldwater East HMP (although this could have been modified had it

been completed as a final plan), 1997 Flat-tailed Horned Lizard Rangewide Management Strategy, and various compliance decisions, as the INRMP for the BMGR. These provisions would be modified to comply with Sikes Act requirements, as outlined under Alternative Management Strategy A in Table 3-3.

Alternative Management Strategies B, C, and D are the alternative actions for BMGR resource management. Table 3-3 describes the provisions of the alternative actions in detail.

3.4.4 Description of the Motorized Access and Unroaded Area Management Alternatives

A provision of the Goldwater Amendment required the development of a transportation sub-plan that would have designated the roads within the BMGR that were to be maintained for public and government use, reserved exclusively for government use, or potentially closed. An extensive multiple-year inventory of roads within the BMGR was completed under the Goldwater Amendment as a first step toward the development of the transportation sub-plan. Preparation of the sub-plan was not completed, however, before the range was renewed two years ahead of the expected schedule under P.L. 99-606 and jurisdiction for managing its lands was transferred to the Secretaries of the Navy and Air Force under the provisions of the MLWA of 1999.

Considerable public comment was received during scoping urging the completion of road network area planning and consideration of unroaded conservation through the development of the proposed INRMP. Thus, the need to complete comprehensive transportation planning for the BMGR became a key task in the development of this EIS. The Core Planning Team determined that the transportation element of the proposed INRMP must identify the range management and public use purposes for maintaining each component of the existing road network and provide a basis for protecting the remaining unroaded areas of the range from the creation of unplanned wildcat roads. The Core Planning Team also identified a need to develop a protocol for evaluating road management issues—including potential retention or closure of existing roads or vehicle travel ways, if any, that were not identified in the current road inventory—that arise after the implementation of the INRMP. It may also become necessary to open or close roads or segments of roads in the future to protect natural or cultural resources or public safety as a result of unforeseen or emerging conditions. The road evaluation protocol is included in Appendix C.

As identified in Section 1.8.2, public participation was invited through the November 2001 and January 2002 public workshops in the planning process for the management of the road network, unroaded areas, and public access within the BMGR. The road network management elements of Alternative Management Strategies A, B, C, and D emerged as a result of public input and Core Planning Team considerations of military mission, resource management, and law enforcement requirements (see Table 3-3).

Alternative Management Strategy A, the no-action alternative, would keep the entire existing road network within the range open for vehicular use. Existing public access to this network, and where and when public access is permissible would initially be unaffected by the implementation of this strategy. Roads could be closed to public access as a result of INRMP planning conducted for future INRMP updates after the currently proposed INRMP is implemented, but the outcome of such planning cannot be predicted at this time.

Alternative Management Strategy B would also keep the entire existing road network open for vehicular use. In addition, Strategy B would endorse the development of additional roads for public use on a case-by-case basis with appropriate environmental planning review. A further key provision of Strategy B would be site specific planning for bypass roads that would reroute government vehicle traffic around the northwest corner of the Cabeza Prieta NWR/Wilderness. Roads could be closed to public access within the BMGR as a result of INRMP planning conducted for future INRMP updates after the currently proposed INRMP is implemented, but the outcome of such planning cannot be predicted at this time.

Alternative Management Strategy C would keep the principal components of the existing network open for vehicular use but would close vehicle access to redundant roads, particularly in local areas with dense road networks. Public access to the road network would be permitted in areas of the range open to the public with the exception of some individual roads that would be open only for government use. Public access to these selected roads would not be allowed for safety, law enforcement, or resource protection purposes. Strategy C would authorize site planning for the two Cabeza Prieta NWR/Wilderness bypass roads but would also emphasize the importance of conserving existing unroaded areas of 3,000 acres or more to the extent that new roads are not needed within these areas to support military or other government purposes. Roads that are not included in the Strategy C network would be closed to further public or routine government use if this strategy were implemented for access and unroaded area management purposes.

Alternative Management Strategy D would maintain only those roads within the BMGR network that are currently foreseen as being necessary for military or other government purposes, which may include an agency mission of providing public access for recreational opportunities. Public access to these roads would be permitted in areas of the range open to the public with the exception of selected individual roads that would be open only for government use. Like Strategy C, Strategy D would emphasize conservation of existing unroaded areas of 3,000 acres or more, to the extent that new roads are not needed within these areas to support military or other government purposes. Strategy D would not authorize site planning for the two Cabeza Prieta NWR/Wilderness bypass roads. Roads that are not included in the Strategy D network would be closed to further public or routine government use if this strategy were implemented for access and unroaded area management purposes.

Roads closed under either Strategies C or D would be intended to remain closed and allowed to revegetate either naturally or with management restoration assistance. Currently unforeseen circumstances may arise, however, that would require reopening of a road otherwise closed as a consequence of implementing the proposed INRMP. Reopening of a closed road to support proposed future military or other government mission would generally require some level of environmental analysis consistent with NEPA or other applicable law before the reopening action is taken. Closed road reuse of a temporary and limited nature that falls short of reopening a road may also be necessary to support certain time-limited management purposes such as resource survey, inventory, or evaluation. Prior coordination with the Air Force, Marine Corps, and other involved agencies and consideration of requirements under NEPA or other applicable law would occur before a decision to proceed with temporary reuse is approved.

Emergency or other time-critical circumstances that require reuse of a closed road for public safety, law enforcement, or certain resource management purposes may preclude the planning and compliance steps that would customarily precede road reopening or reuse. In these cases, reuse of a road would be pursued only if there is no alternative to resolving the immediate safety or law enforcement or time-critical resource management need other than through vehicle access. Reuse of a road would also not be pursued unless off-road, cross-country travel is the only other option for vehicle access. Closed road reuse, under these circumstances, would be expected to be limited in both duration and frequency.

The U.S. Border Patrol is the agency with a mission that would be most likely to require temporary reuse of closed roads. The Border Patrol has the multiple responsibilities of deterring UDAs from illegally entering the United States, apprehending UDAs who have already entered the country, and providing search and rescue services when the lives of UDAs or others are threatened by dehydration, heat-related illness, or other emergencies. The Border Patrol participated in the road planning component of this EIS and the roads routinely used by this agency in the performance of its mission are included in each of the alternative management strategies. The Border Patrol intends to avoid using roads designated as closed to public and routine government use as a result of the eventual implementation of the proposed INRMP unless other circumstances require the use of these roads in order to meet this agency's primary law enforcement or life saving responsibilities. Closed roads would generally be used as the access priority over off-road, cross-country travel to accomplish time-critical enforcement or life-saving missions.

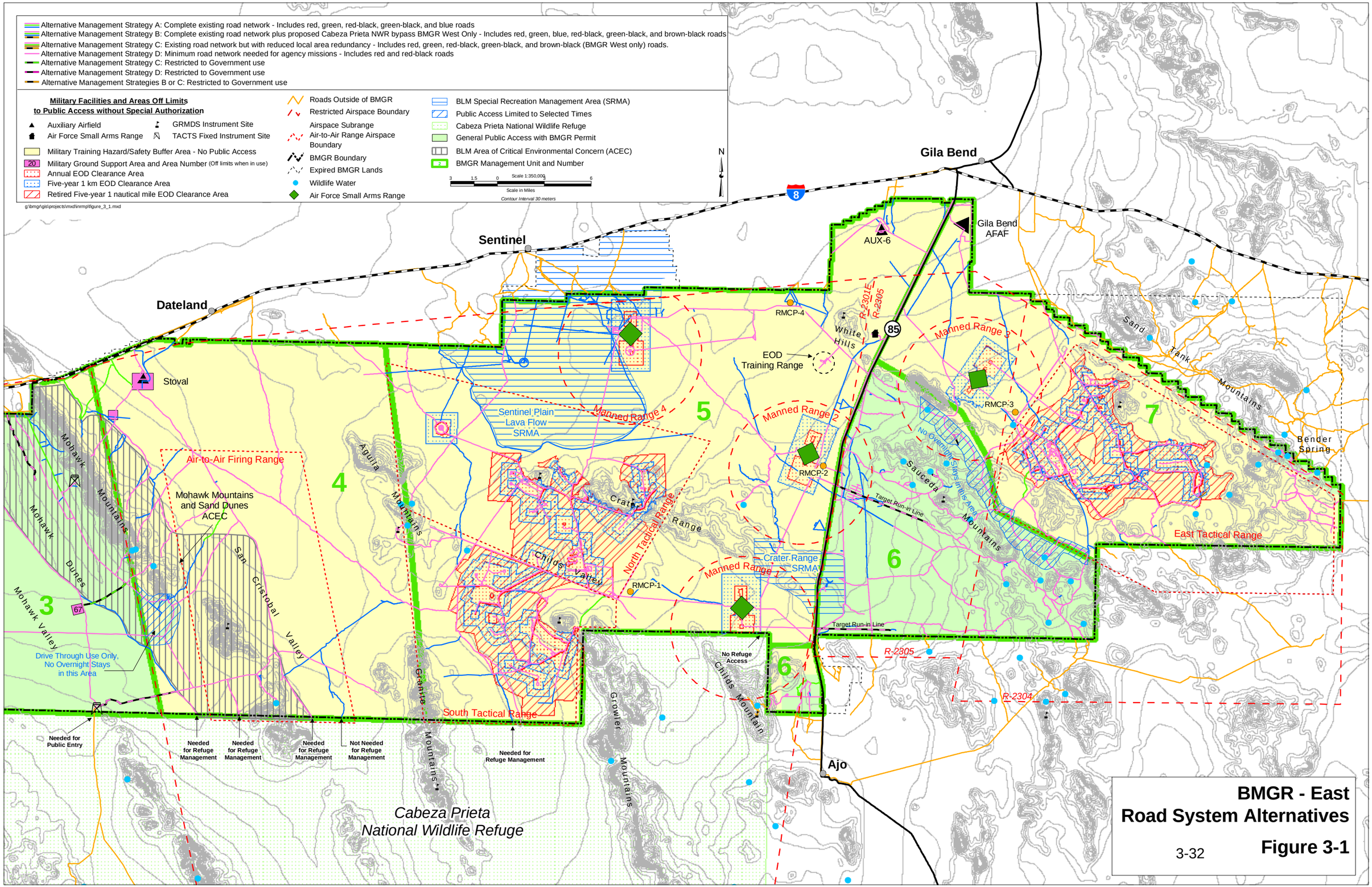
Other agencies with responsibilities on the BMGR would also maintain emergency road use privileges, similar to those of the Border Patrol, for responding to time-critical or emergency circumstances such as aircraft crashes or immediate law-enforcement, security, or public safety situations. Some emerging resource management activities—such as wildfire suppression or endangered or threatened species protection—may warrant time-critical road reuse. These privileges would not be invoked to support unplanned, unforeseen, but otherwise non-time-critical activities. Coordination with the range management offices of the Air Force or Marine Corps

would precede the closed road reuse to the extent compatible with the requirements of the time-critical action. In any event, the appropriate Air Force or Marine Corps range management office would be notified of the road reuse action and the need for such action as soon as possible following the event.

The proposed road networks for the range associated with Alternative Management Strategies A, B, C, and D are shown in Figure 3-1 for BMGR—East and Figure 3-2 for BMGR—West. The various road network alternatives are color-coded in these figures. Washes are currently a part of the inventoried road system only where they are parts of designated roads. Driving in washes is allowed only where the wash is a designated part of the road system and is dry. The roads that would be retained if the minimum road network were implemented under Alternative Management Strategy D are shown in red. The additional roads that would be maintained in the network under Alternative Management Strategy C are shown in green. Consequently, the Alternative Management Strategy C road network would include the roads identified under Strategies D and C and coded in red and green. Alternative Management Strategy A would maintain the entire existing road network. The additional roads that would be maintained in the network under Alternative Management Strategy A are shown in blue.

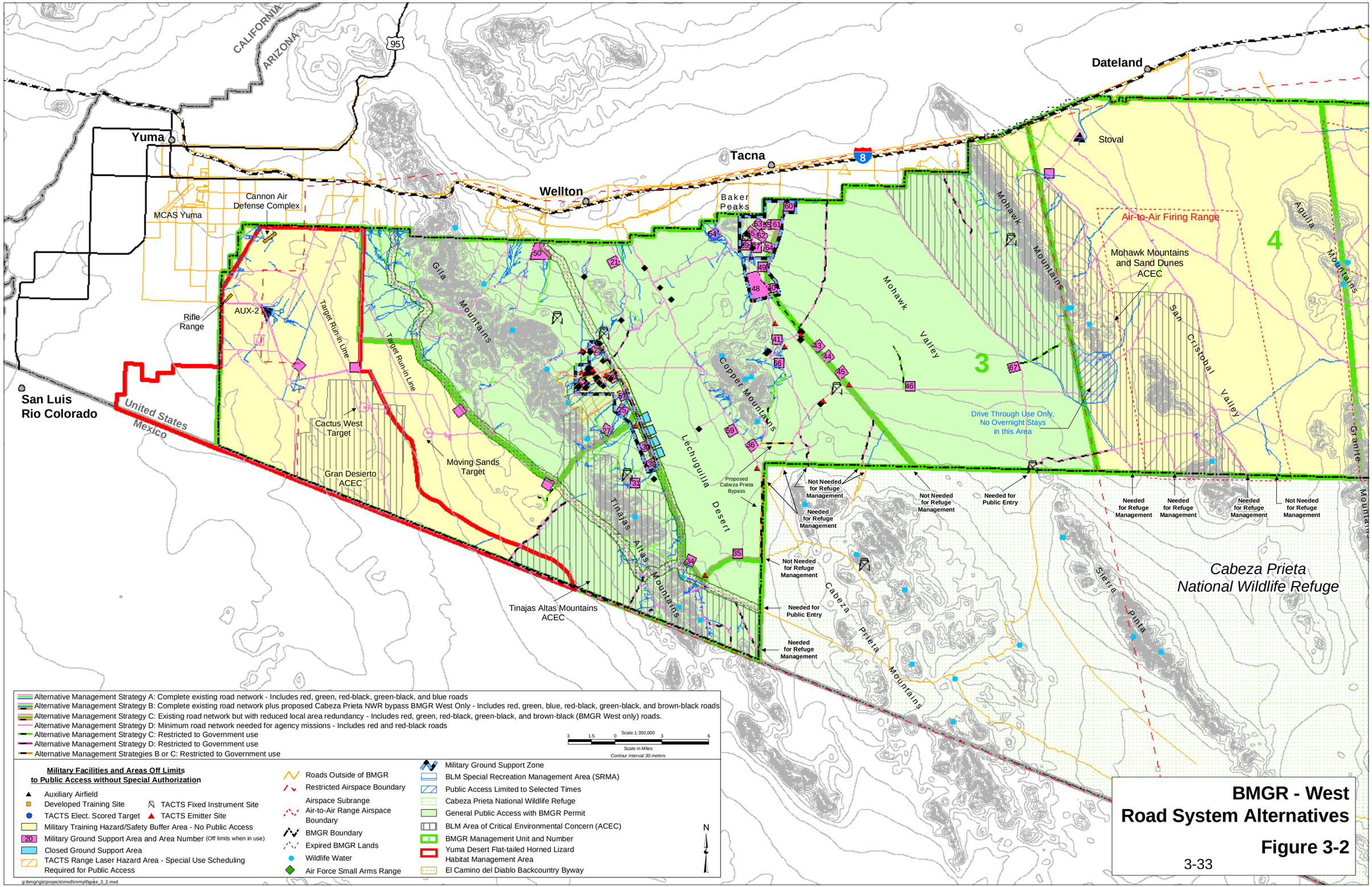
Thus, the Alternative Management Strategy A road network would include the roads identified under Strategies D, C, and A and coded in red, green, and blue. The two Cabeza Prieta NWR/Wilderness bypass roads that would be promoted under Alternative Management Strategies B or C are shown in brown. If Alternative Management Strategy B were implemented, these two bypass roads could be added to the entire existing road network, coded in red, green, and blue as for Strategy A. If Alternative Management Strategy C were implemented, these two bypass roads could be added as an option to the Strategy C road network, coded in red and green.

One issue that may influence the potential for future road closures regards protection of cultural resources. Cultural resources recorded on BMGR to date include artifact scatters, clusters of fire-cracked rock, sleeping circles, intaglios or geoglyphs, rock art, rock shelters, cairns, shrines, historic-period smelters and mines, ranches, and military training facilities dating back to World War II. Unlike sites in other parts of the Southwest, many of the archaeological sites recorded on BMGR are almost entirely surficial; that is, they lack substantial buried components. As such, they are especially vulnerable to damage or destruction through casual use—even one-time use—and especially from off-road driving. Even pulling off the road to park a vehicle or to turn around can cause extensive damage to this type of cultural resource site. To prevent or minimize such impacts to sensitive cultural and natural resources, some short road segments on BMGR have been closed; however, other closures may be implemented as other resources requiring protection are identified.



BMGR - East Road System Alternatives

Figure 3-1



BMGR - West
Road System Alternatives

Figure 3-2

The proposed INRMP will not address cultural resource protection proactively, except in general terms, because most of the range has not been systematically surveyed for cultural resources, including most drainage corridors. Completed surveys encompass less than 10 percent of the total range, and this effort has concentrated on areas impacted by military use. The costs of surveying the entire range for cultural resources would be exorbitant and are therefore not required to comply with NEPA (40 CFR §1502.22(b)). Because very little of the area currently open to public access or proposed for public use has been systematically surveyed, it is not possible to include a detailed assessment of road closures or other management measures that might be required to protect specific cultural resource sites from potential public access effects. The resource protection strategy developed in the ICRMP includes road closures as one of several tools that may be used to avoid or minimize damage to cultural resources. The Air Force and Marine Corps may need to implement some road or road segment closures and/or other preservation measures in the future to protect cultural resources during the five-year span covered by the proposed INRMP and ICRMP.

Road closures would be only one of several options that would be considered in designing and implementing cultural resource protection measures. Such closures, if needed, would be designed to have as little impact on access as possible while providing an adequate level of protection for the resources in question. Resource protection actions would be consistent with the Air Force's and Marine Corps' legal obligations under ARPA, NHPA, and other statutes.

3.4.4.1 No-Action Alternative—Existing Motorized Access and Unroaded Area Status

There are 2,222 miles of inventoried roads within the existing road network, which would be retained under Alternative Management Strategy A (Table 3-6). BMGR—West contains 1,019 miles of these roads and the remaining 1,203 miles are located in BMGR—East. A total of 973 miles, or 44 percent, of the existing BMGR roads are currently available for general public access. Almost 79 percent, or 767 miles, of the inventoried roads available for general public access are located within BMGR—West, of which about 19, 69, and 12 percent are within Management Units 1, 2, and 3, respectively (see Tables 3-6 through 3-9 and Figure 3-2). Approximately 94 percent of the 206 miles of road available for general public access within BMGR—East are located within Management Unit 6 (see Table 3-6, Tables 3-10 through 3-13, and Figure 3-1).

About 66 miles of single-lane, paved roads are located within the BMGR excluding paved roads and parking areas within Gila Bend AFAF and the Cannon Air Defense Complex. About 23 miles of single-lane paved road provide access to the Rifle Range, AUX-2, the Moving Sands and Cactus West target complexes, and the Ordnance Jettison Area in BMGR—West (see Figure 2-2). About 43 miles of single-lane pavement in five separate segments provide access to Manned Ranges 1, 2, 3, and 4 and communication facilities on Childs Mountain in BMGR—East (see Figure 2-1). State Route 85 is a paved, high-speed, two-lane highway that traverses almost 35

TABLE 3-6
MILES AND AREA OF ROADS WITHIN THE BMGR UNDER THE PROPOSED ACTION AND EACH ALTERNATIVE MANAGEMENT STRATEGY

Access Status of Roads for Government and Public Access	No-Action Alternative (Alternative Management Strategy A[1])	Alternative Management Strategy B[2]	Proposed Action (Alternative Management Strategy C[3])	Alternative Management Strategy D[4]
1. Miles of road within BMGR—West restricted military use areas that are not open to general public access	189	189	134	124
2. Miles of road within BMGR—East restricted military use areas that are not open to general public access	985	985	734	719
3. Total miles of roads in BMGR restricted areas (Lines 1+2)	**1,174**	**1,174**	**868**	**843**
4. Miles of road within BMGR—West outside of restricted areas but restricted to government use only	63	70	63	48
5. Miles of road within BMGR—East outside of restricted areas but restricted to government use only	12	12	12	12
6. Total miles of roads in BMGR outside of restricted areas but restricted to government use only (Lines 4+5)	**75**	**82**	**75**	**60**
7. Miles of BMGR—West roads outside of restricted military use areas that are generally open to public access [5]	767	767	447	383
8. Miles of BMGR—East roads outside of restricted military use areas that are generally open to public access [5]	206	206	174	171
9. Total miles of BMGR roads outside of restricted military use areas that are generally open to public access[5] (Lines 7+8)	**973**	**973**	**621**	**554**
10. Total miles of roads in BMGR—West of all types (Lines 1+4+7)	**1,019**	**1,026**	**643**	**555**
11. Total miles of roads in BMGR— East of all types (Lines 2+5+8)	**1,203**	**1,203**	**920**	**902**
12. Total miles of BMGR roads of all types (Lines 3+6+9)	**2,222**	**2,229**	**1,564**	**1,457**
Approximate surface area (acres) of all BMGR roads based on a 30-foot road width [6]	8,080	8,105	5,687	5,298

[1] The no-action alternative includes roads coded as A, C, and D, equivalent to existing network.
[2] Includes roads coded as A, B, C, and D.
[3] Proposed action includes roads coded as C and D; B roads (consisting of the 7 miles of Cabeza Prieta bypass roads) could be added as an authorized future option, but are not included in these figures.
[4] Includes roads coded as D.
[5] Roads are subject to future temporary or permanent closures for safety, security, or resource protection purposes.
[6] Widths of improved and unimproved roadways vary on the BMGR from 6 to 60 feet; 30 feet is a conservative width index that represents a potential upper limit of the aggregate area occupied by roads and affected shoulder areas.

TABLE 3-7
MILES AND AREA OF ROADS WITHIN MANAGEMENT UNIT 1 UNDER THE PROPOSED ACTION AND EACH ALTERNATIVE MANAGEMENT STRATEGY

Access Status of Roads for Government and Public Access	No-Action Alternative (Alternative Management Strategy A[1])	Alternative Management Strategy B[2]	Proposed Action (Alternative Management Strategy C[3])	Alternative Management Strategy D[4]
Miles of road within restricted military use areas that are not open to general public access	177	177	124	122
Miles of road outside of restricted areas but restricted to government use only	21	21	21	21
Miles of roads outside of restricted military use areas that are generally open to public access[5]	142	142	78	56
Total miles of roads	**340**	**340**	**223**	**199**
Approximate surface area (acres) of all roads based on a 30-foot road width[6]	1,236	1,236	811	724

[1] The no-action alternative includes roads coded as A, C, and D, equivalent to existing network.
[2] Includes roads coded as A, B, C, and D.
[3] Proposed action includes includes roads coded as C and D.
[4] Includes roads coded as D.
[5] Roads are subject to future temporary or permanent closures for safety, security, or resource protection purposes.
[6] Widths of improved and unimproved roadways vary on the BMGR from 6 to 60 feet; 30 feet is a conservative width index that represents a potential upper limit of the aggregate area occupied by roads and affected shoulder areas.

TABLE 3-8
MILES AND AREA OF ROADS WITHIN MANAGEMENT UNIT 2 UNDER THE PROPOSED ACTION AND EACH ALTERNATIVE MANAGEMENT STRATEGY

Access Status of Roads for Government and Public Access	No-Action Alternative (Alternative Management Strategy A[1])	Alternative Management Strategy B[2]	Proposed Action (Alternative Management Strategy C[3])	Alternative Management Strategy D[4]
Miles of road within restricted military use areas that are not open to general public access	0	0	0	0
Miles of road outside of restricted areas but restricted to government use only	16	23	16	9
Miles of roads outside of restricted military use areas that are generally open to public access[5]	531	531	294	259
Total miles of roads	**547**	**554**	**310**	**268**
Approximate surface area (acres) of all roads based on a 30-foot road width[6]	1,989	2,015	1,127	975

[1] The no-action alternative includes roads coded as A, C, and D, equivalent to existing network.
[2] Includes roads coded as A, B, C, and D.
[3] Proposed action includes roads coded as C and D; B roads (consisting of the 7 miles of Cabeza Prieta bypass roads) could be added as an authorized future option, but are not included in these figures.
[4] Includes roads coded as D.
[5] Roads are subject to future temporary or permanent closures for safety, security, or resource protection purposes.
[6] Widths of improved and unimproved roadways vary on the BMGR from 6 to 60 feet; 30 feet is a conservative width index that represents a potential upper limit of the aggregate area occupied by roads and affected shoulder areas.

TABLE 3-9
MILES AND AREA OF ROADS WITHIN MANAGEMENT UNIT 3 UNDER THE PROPOSED ACTION AND EACH ALTERNATIVE MANAGEMENT STRATEGY

Access Status of Roads for Government and Public Access	No-Action Alternative (Alternative Management Strategy A[1])	Alternative Management Strategy B[2]	Proposed Action (Alternative Management Strategy C[3])	Alternative Management Strategy D[4]
Miles of road within restricted military use areas that are not open to general public access	12	12	10	2
Miles of road outside of restricted areas but restricted to government use only	26	26	26	18
Miles of roads outside of restricted military use areas that are generally open to public access [5]	94	94	75	68
Total miles of roads	**132**	**132**	**111**	**88**
Approximate surface area (acres) of all roads based on a 30-foot road width[6]	480	480	404	320

[1] The no-action alternative includes roads coded as A, C, and D, equivalent to existing network.
[2] Includes roads coded as A, B, C, and D.
[3] Proposed action includes roads coded as C and D.
[4] Includes roads coded as D.
[5] Roads are subject to future temporary or permanent closures for safety, security, or resource protection purposes.
[6] Widths of improved and unimproved roadways vary on the BMGR from 6 to 60 feet; 30 feet is a conservative width index that represents a potential upper limit of the aggregate area occupied by roads and affected shoulder areas.

TABLE 3-10
MILES AND AREA OF ROADS WITHIN MANAGEMENT UNIT 4 UNDER THE PROPOSED ACTION AND EACH ALTERNATIVE MANAGEMENT STRATEGY

Access Status of Roads for Government and Public Access	No-Action Alternative (Alternative Management Strategy A[1])	Alternative Management Strategy B[2]	Proposed Action (Alternative Management Strategy C[3])	Alternative Management Strategy D[4]
Miles of road within restricted military use areas that are not open to general public access	197	197	148	138
Miles of road outside of restricted areas but restricted to government use only	1	1	1	1
Miles of roads outside of restricted military use areas that are generally open to public access [5]	6	6	6	6
Total miles of roads	**204**	**204**	**155**	**145**
Approximate surface area (acres) of all roads based on a 30-foot road width[6]	742	742	564	527

[1] The no-action alternative includes roads coded as A, C, and D, equivalent to existing network.
[2] Includes roads coded as A, B, C, and D.
[3] Proposed action includes roads coded as C and D.
[4] Includes roads coded as D.
[5] Roads are subject to future temporary or permanent closures for safety, security, or resource protection purposes.
[6] Widths of improved and unimproved roadways vary on the BMGR from 6 to 60 feet; 30 feet is a conservative width index that represents a potential upper limit of the aggregate area occupied by roads and affected shoulder areas.

TABLE 3-11
MILES AND AREA OF ROADS WITHIN MANAGEMENT UNIT 5 UNDER THE PROPOSED ACTION AND EACH ALTERNATIVE MANAGEMENT STRATEGY

Access Status of Roads for Government and Public Access	No-Action Alternative (Alternative Management Strategy A[1])	Alternative Management Strategy B[2]	Proposed Action (Alternative Management Strategy C[3])	Alternative Management Strategy D[4]
Miles of road within restricted military use areas that are not open to general public access	540	540	376	374
Miles of road outside of restricted areas but restricted to government use only	0	0	0	0
Miles of roads outside of restricted military use areas that are generally open to public access [5]	0	0	0	0
Total miles of roads	**540**	**540**	**376**	**374**
Approximate surface area (acres) of all roads based on a 30-foot road width[6]	1,964	1,964	1,367	1,360

[1] The no-action alternative includes roads coded as A, C, and D, equivalent to existing network.
[2] Includes roads coded as A, B, C, and D.
[3] Proposed action includes roads coded as C and D.
[4] Includes roads coded as D.
[5] Roads are subject to future temporary or permanent closures for safety, security, or resource protection purposes.
[6] Widths of improved and unimproved roadways vary on the BMGR from 6 to 60 feet; 30 feet is a conservative width index that represents a potential upper limit of the aggregate area occupied by roads and affected shoulder areas.

TABLE 3-12
MILES AND AREA OF ROADS WITHIN MANAGEMENT UNIT 6 UNDER THE PROPOSED ACTION AND EACH ALTERNATIVE MANAGEMENT STRATEGY

Access Status of Roads for Government and Public Access	No-Action Alternative (Alternative Management Strategy A[1])	Alternative Management Strategy B[2]	Proposed Action (Alternative Management Strategy C[3])	Alternative Management Strategy D[4]
Miles of road within restricted military use areas that are not open to general public access	12	12	12	12
Miles of road outside of restricted areas but restricted to government use only	11	11	11	11
Miles of road in locations outside of restricted military use areas that are generally open to public access [5]	194	194	162	160
Total miles of roads	**217**	**217**	**185**	**183**
Approximate surface area (acres) of all roads based on a 30-foot road width[6]	789	789	673	665

[1] The no-action alternative includes roads coded as A, C, and D, equivalent to existing network.
[2] Includes roads coded as A, B, C, and D.
[3] Proposed action includes roads coded as C and D.
[4] Includes roads coded as D.
[5] Roads are subject to future temporary or permanent closures for safety, security, or resource protection purposes.
[6] Widths of improved and unimproved roadways vary on the BMGR from 6 to 60 feet; 30 feet is a conservative width index that represents a potential upper limit of the aggregate area occupied by roads and affected shoulder areas.

TABLE 3-13
MILES AND AREA OF ROADS WITHIN MANAGEMENT UNIT 7 UNDER THE PROPOSED ACTION AND EACH ALTERNATIVE MANAGEMENT STRATEGY

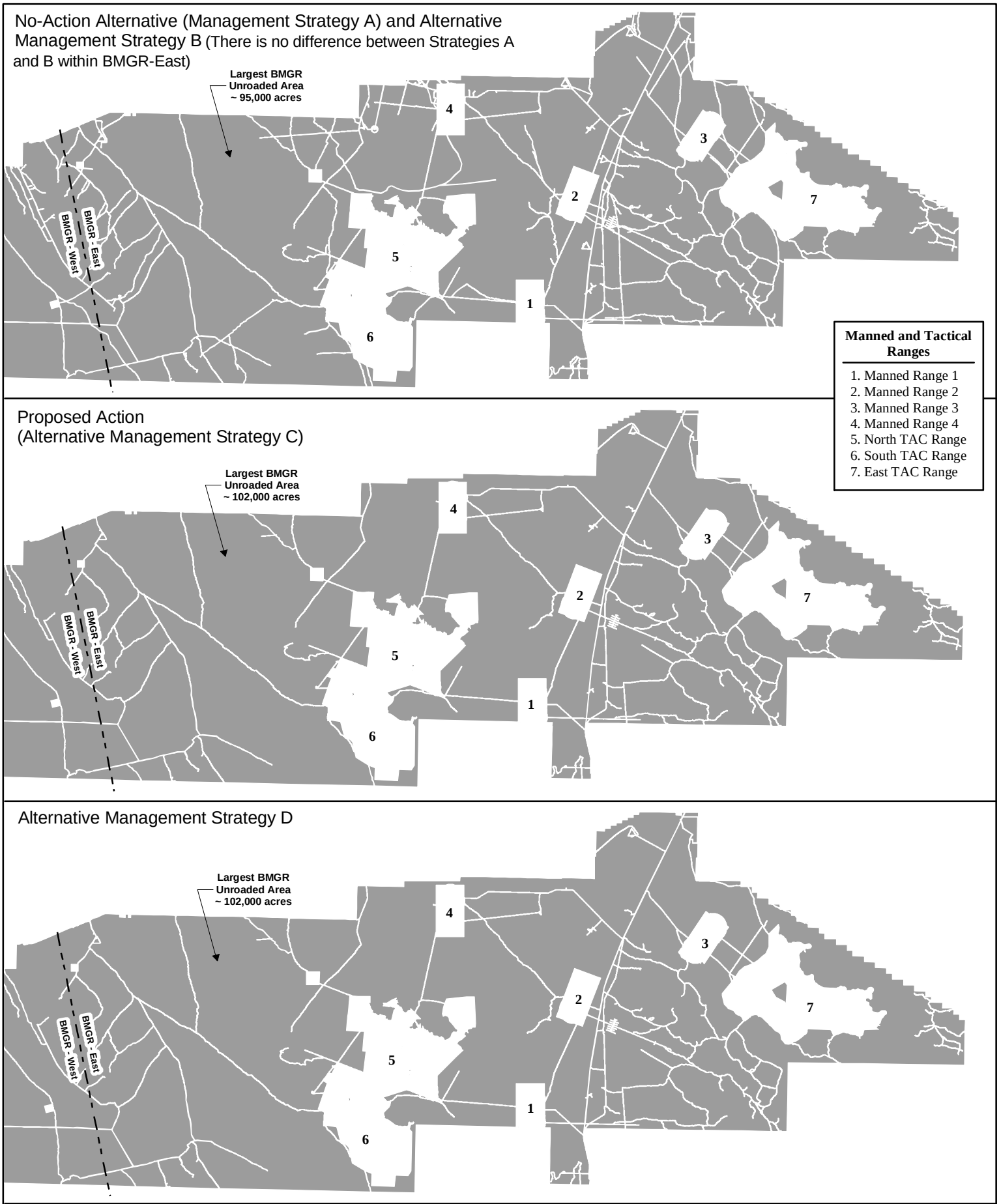
Access Status of Roads for Government and Public Access	No-Action Alternative (Alternative Management Strategy A[1])	Alternative Management Strategy B[2]	Proposed Action (Alternative Management Strategy C[3])	Alternative Management Strategy D[4]
Miles of road within restricted military use areas that are not open to general public access	236	236	198	195
Miles of road outside of restricted areas but restricted to government use only	0	0	0	0
Miles of roads outside of restricted military use areas that are generally open to public access [5]	6	6	6	5
Total miles of roads	**242**	**242**	**204**	**200**
Approximate surface area (in acres) of all roads based on a 30-foot road width[6]	880	880	742	727

[1] The no-action alternative includes roads coded as A, C, and D, equivalent to existing network.
[2] Includes roads coded as A, B, C, and D.
[3] Proposed action includes roads coded as C and D.
[4] Includes roads coded as D.
[5] Roads are subject to future temporary or permanent closures for safety, security, or resource protection purposes.
[6] Widths of improved and unimproved roadways vary on the BMGR from 6 to 60 feet; 30 feet is a conservative width index that represents a potential upper limit of the aggregate area occupied by roads and affected shoulder areas.

miles of BMGR—East from north to south between Gila Bend and Ajo, Arizona. The rest of the 2,121 miles of road inventoried within the range includes a variety of improved (i.e., bladed) and unimproved routes with roadbeds composed of sand, gravel, cobbles, rock, or other natural soil materials. Many, if not most, of these roads are unimproved and are less than 12 feet wide. A large proportion of the unimproved roads are little more than primitive cross-country vehicle routes that have been established by repeated vehicular traffic.

Although there is a substantial and widely dispersed existing road network within the BMGR, extensive areas of the range remain free of roads. The unroaded extent of the range can be characterized in terms of the cumulative surface area that is subject to vehicular use as compared to the area that is free from roads or other established vehicular use areas, by identifying the numbers and sizes of unroaded areas, and through map graphics (Figures 3-3 and 3-4).

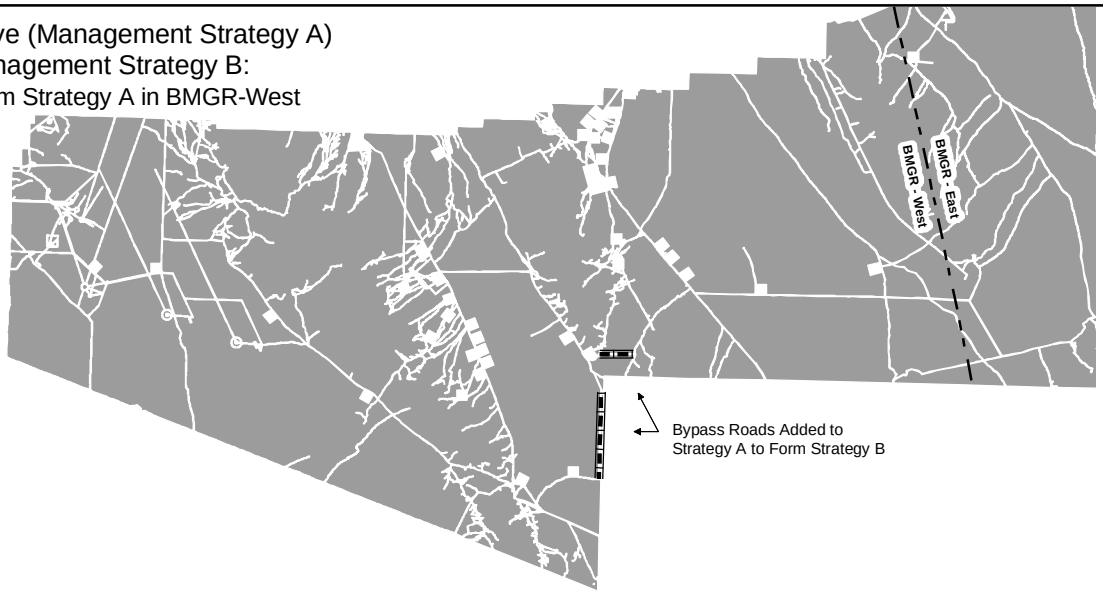
The surface area of the range that is occupied by roads can be determined from the collective length of the network and width of the roads within that network. With the exception of State Route 85, roads within the BMGR vary in width from approximately 6 to 60 feet. The narrowest roads are nothing more than established tracks caused by the repeated passage of vehicles. The widest roadways are improved roads with roadbeds of 30 feet or more and graded shoulders and drainage ditches. The average width of BMGR roadways, including graded or otherwise affected shoulders, has not been determined. A rough estimate of the aggregate area of the range affected



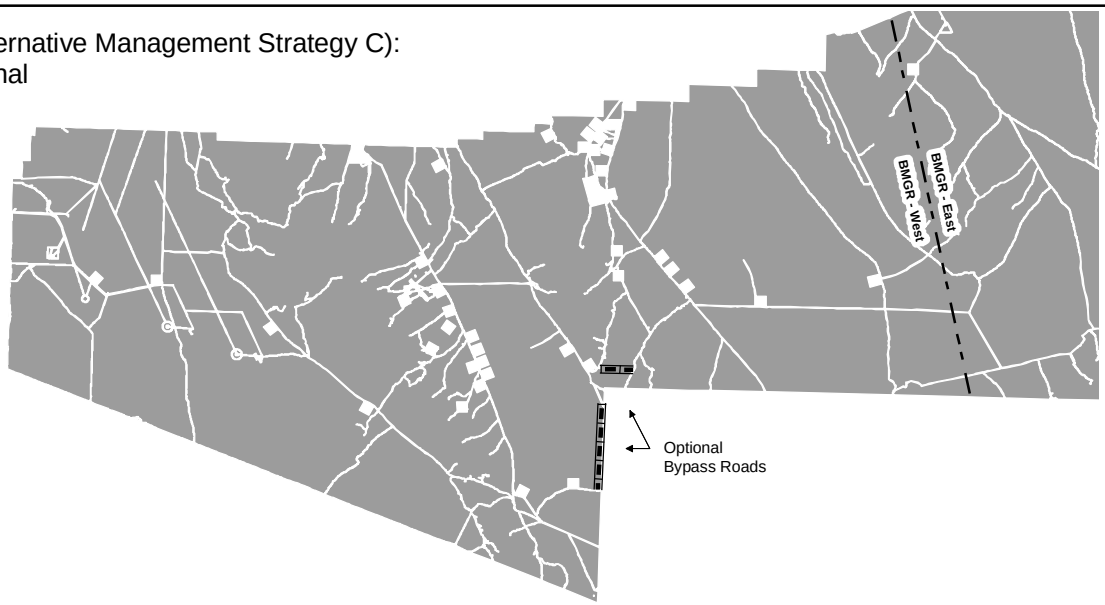
BMGR - East
Unroaded Areas Associated with the Proposed Action and Alternative Management Strategies

Figure 3-3

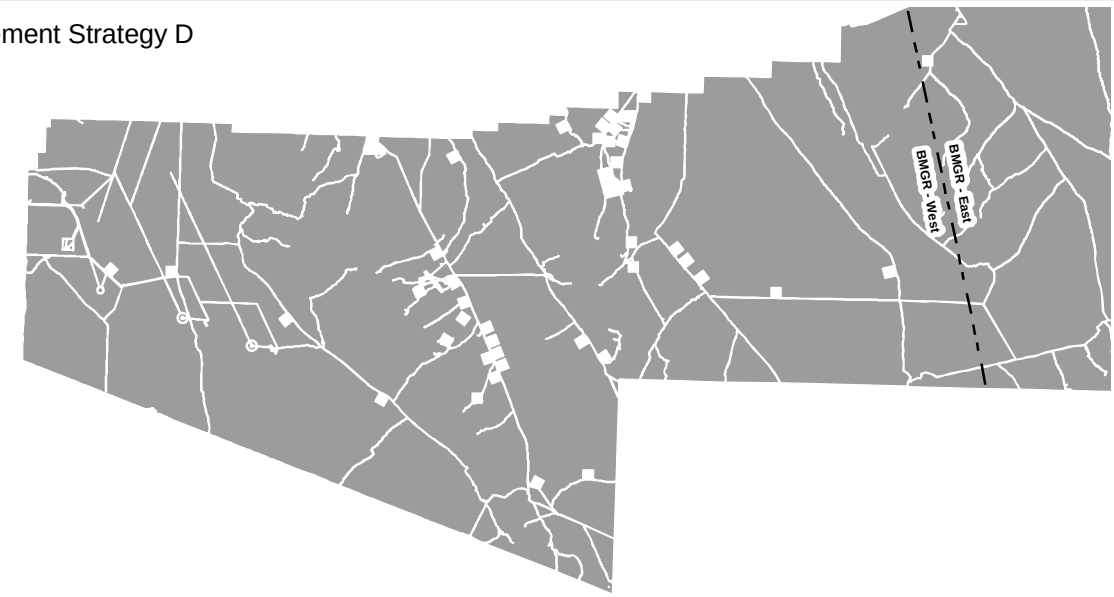
No-Action Alternative (Management Strategy A) and Alternative Management Strategy B:
(Strategy B differs from Strategy A in BMGR-West only in terms of the Cabeza Prieta NWR bypass roads)

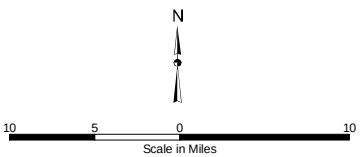


Proposed Action (Alternative Management Strategy C):
Bypass Roads Optional



Alternative Management Strategy D





Unroaded Area
Road Corridor
Active or Inactive Military Training or Support Area Approved for Military Vehicular Use
Cabeza Prieta Wilderness Bypass Road

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BMGR - West
Unroaded Areas Associated with the Proposed Action and Alternative Management Strategies
Figure 3-4

by roadways was calculated for use in this EIS, however, by assuming that an average roadway width of 30 feet is representative of the potential upper limit of the aggregate surface effect area of all roads and affected shoulder areas within the network. Based on this roadway width, the 2,222 miles of existing roads within the range would occupy an aggregate surface area of approximately 8,000 acres. Although most roadways on the range are believed to be less than 30 feet in width, this figure was selected for this rough estimate as a conservative figure that would include most associated vehicle pullout and turn around areas and is not likely to underestimate the aggregate surface area of roads within the BMGR. Eight thousand acres is less than 0.5 percent of the 1,733,921 acres that make up the total surface area of the BMGR.

Roads, however, comprise a small portion of the area of the range that is authorized for vehicular use. Established vehicular use areas other than roads include the annual and five-year EOD clearance areas within air-to-ground weapons ranges, target and range maintenance areas, and Marine Corps ground support areas. As explained in Sections 2.2.1 and 2.3.2.4, five-year EOD clearance areas for Air Force tactical and manned ranges extended to a radius of one nautical mile from each target from 1975 until August 2001 when the clearance radius was shortened to one kilometer in accordance with AFI 13-212 Volume 1. The reduced five-year EOD clearance area provides effective target surface area decontamination that is commensurate with the extent to which munitions are dispersed by current aircraft weapon systems and training practices. The five-year EOD clearance areas have not been extensively affected by vehicular use (only six clearance cycles have occurred since 1975). In general, the vegetative communities and soils of the five-year clearance areas remain relatively intact. These areas, however, show signs of methodical vehicular use and cannot be regarded as unroaded in contrast to unaffected adjacent areas that are outside the clearance area perimeters. The density and frequency of vehicular traffic within the annual clearance areas has been much higher. Including the now inactive one-nautical-mile five-year clearance areas, the annual and five-year EOD clearance areas within the BMGR encompass 154,150 acres. (The advent of the one-kilometer five-year clearance radius reduced the current combined EOD clearance area to about 95,000 acres.)

Core target areas are more heavily impacted by ordnance deliveries and vehicular traffic from target construction and maintenance than the annual or five-year EOD clearances. In addition to the annual EOD clearance surface area, core target areas collectively include about 1,800 acres. Range maintenance areas include the four RMCPs and dispersed sites within the tactical ranges that are used as temporary EOD consolidation points and vehicular assembly areas. Range maintenance areas collectively comprise about 435 acres that should be excluded from the consideration of unroaded areas.

The Marine Corps ground support areas, which are approved for off-road vehicular use in support of military training activities, total approximately 10,900 acres in surface area. Other range locations that collectively encompass about 5,400 acres and that do not qualify as having unroaded characteristics include eight World War II vintage auxiliary airfields, Gila Bend AFAF, the two

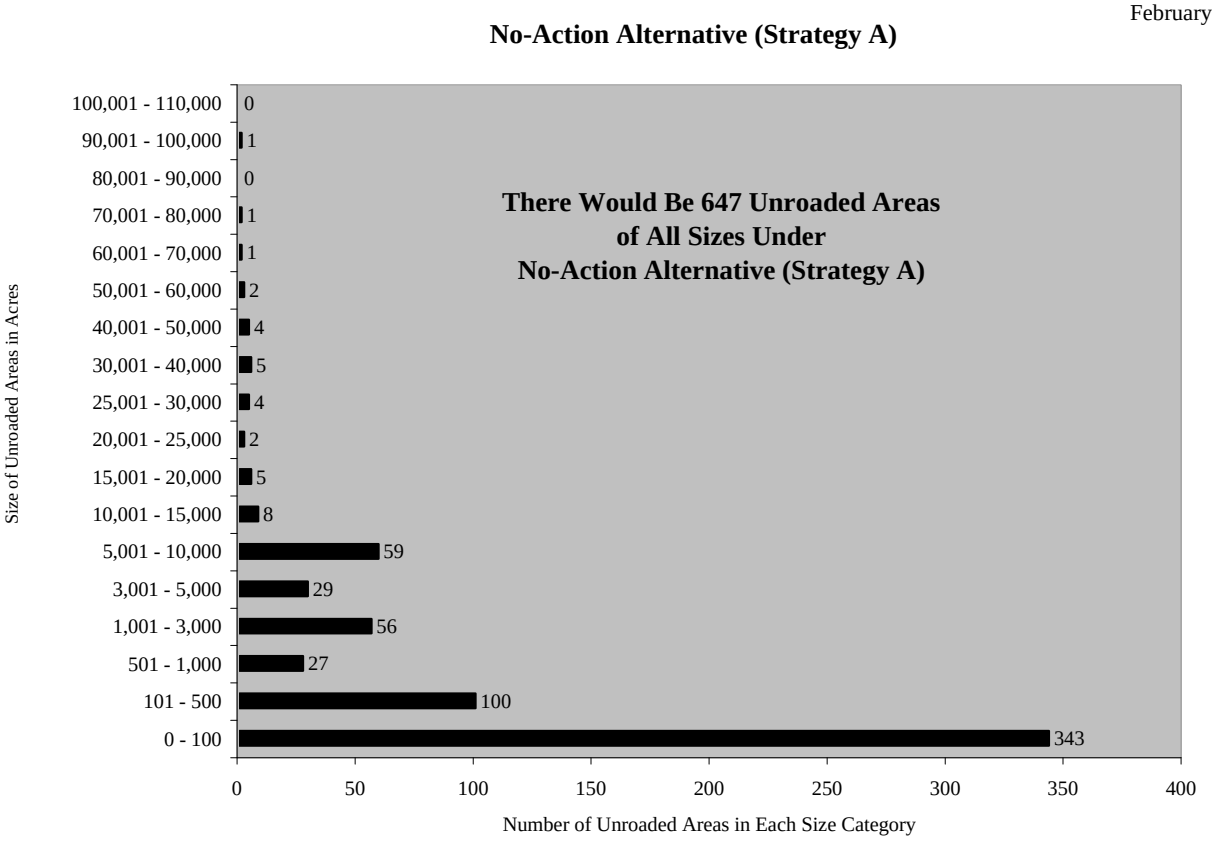
small arms ranges, the Cannon Air Defense Complex, and two retired Air Force test areas. In total, the military use areas that should be excluded from the consideration of the unroaded area of the BMGR cumulatively incorporate approximately 172,700 acres. Adding the estimated surface area of the existing inventory road network to this figure brings the total range surface area that should be excluded from the determination of the unroaded surface area of the BMGR to approximately 180,750 acres, or about 10 percent of the range. This analysis shows that about 90 percent of the BMGR is unroaded in terms of the existing inventoried road network and other established vehicular use or developed areas.

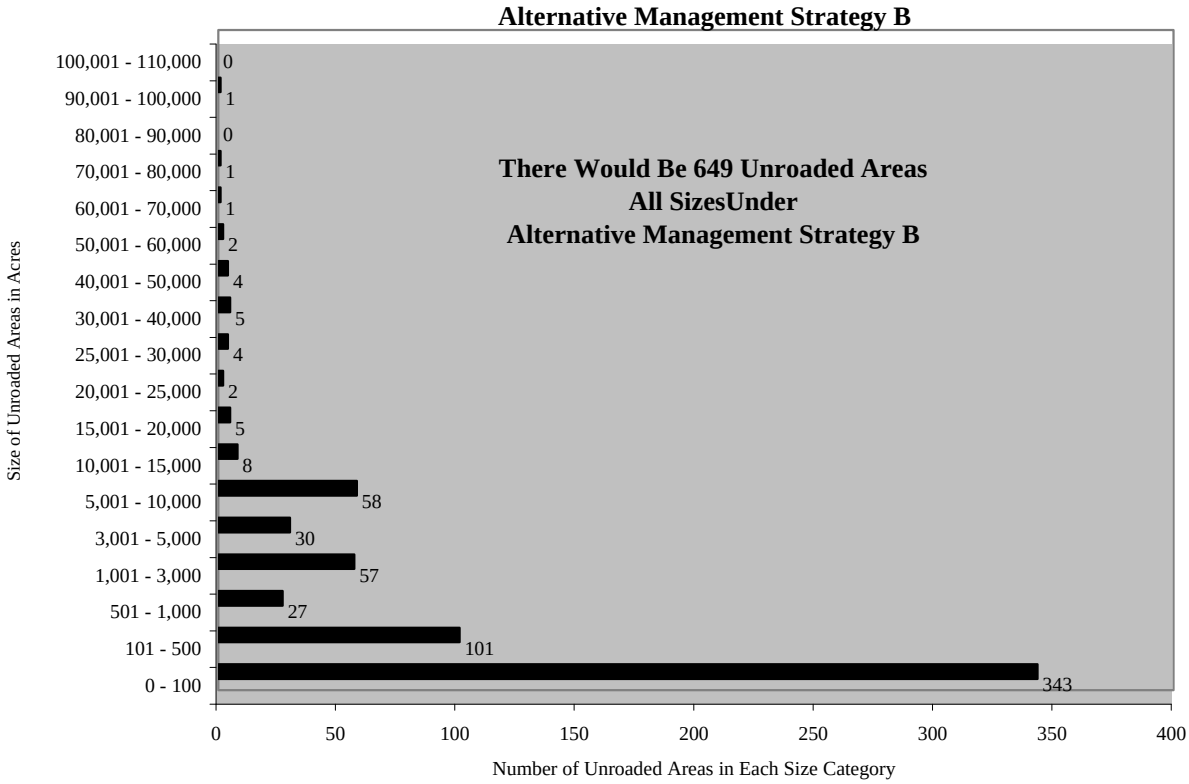
The proposed action (Strategy C) and Alternative Management Strategy D both call for the conservation of existing unroaded areas of 3,000 acres or more in size. A determination of the number of range areas with surface areas in 20 various size categories from 1 to 120,000+ acres, including 3,000 acres or less and 3,001 acres or more as one of the category dividing points, was performed through a Geographic Information System (GIS) analysis. The existing road network was buffered to a width of 100 feet for this analysis to represent the distance (50 feet) on either side of the road to which vehicles may currently be pulled off of the road for parking. The other established military vehicle-use areas and developed areas described previously that incorporate 172,700 acres were also excluded in the analysis of unroaded areas. The GIS analysis results show that there are 121 existing unroaded areas of 3,001 acres or more and 526 areas of 3,000 acres or less within the BMGR (Figure 3-5). Given the existing road network, the largest unroaded area is about 95,000 acres located in BMGR—East west of North and South Tactical Ranges (see Figure 3-3). There are 88, unroaded areas of 3,001 to 10,000 acres, 28 unroaded area of 10,001 to 50,000 acres, and five unroaded areas of more than 50,000 acres under the existing conditions.

3.4.4.2 Proposed Action—Motorized Access and Unroaded Area Status

The proposed action for motorized access and unroaded areas is Alternative Management Strategy C, which would retain 1,564 miles of the roads within the existing road network, with 643 miles in BMGR—West and 920 miles in BMGR—East (see Table 3-6). The proposed action would reduce the cumulative length of the existing BMGR road network by 658 miles, or 30 percent. This range-wide reduction would decrease the total miles of roads within BMGR—West and BMGR—East by about 37 and 24 percent, respectively. Some of the roads that would remain would be available only for agency use. Consequently, 621 miles of roads would be available for general public access under the proposed action, which is 352 miles or 36 percent less than is currently available under the existing conditions (see Table 3-6).

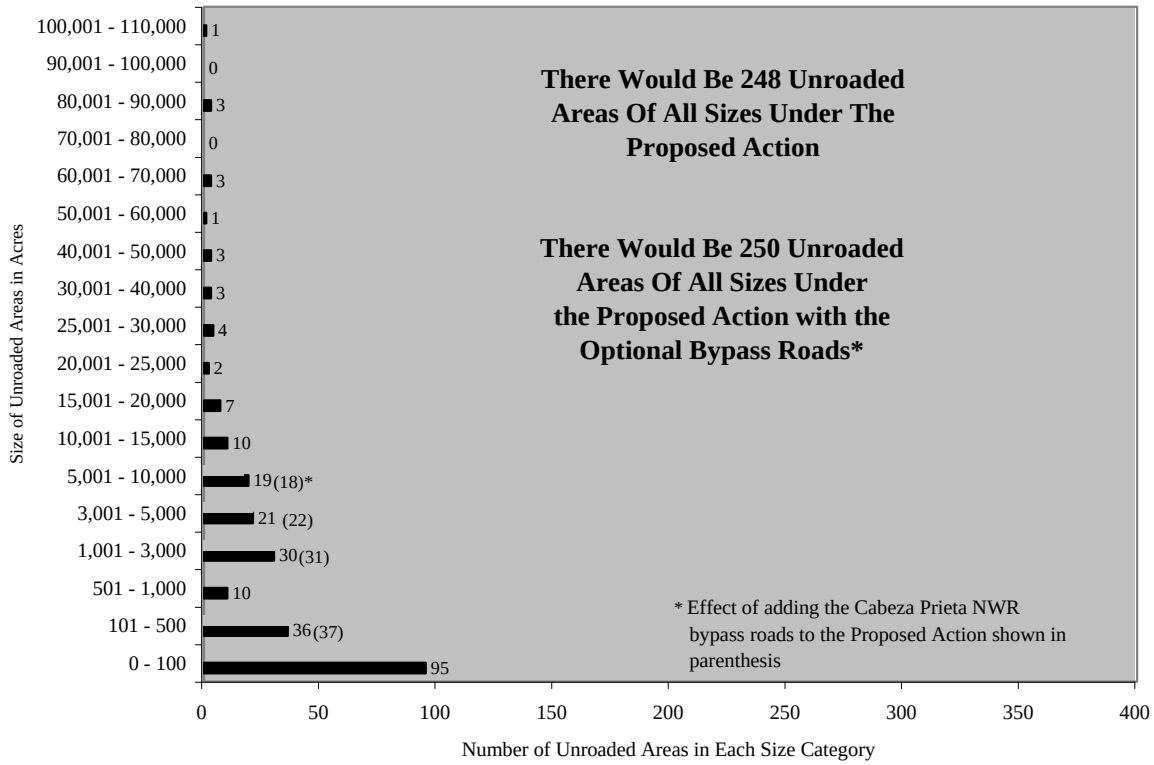
Most of the reduction in available general public access road mileage would occur in BMGR—West where almost 91 percent (or 320 miles) of the decrease would occur. This outcome is not surprising considering the high densities of roads in Management Units 1 and 2 located in the areas



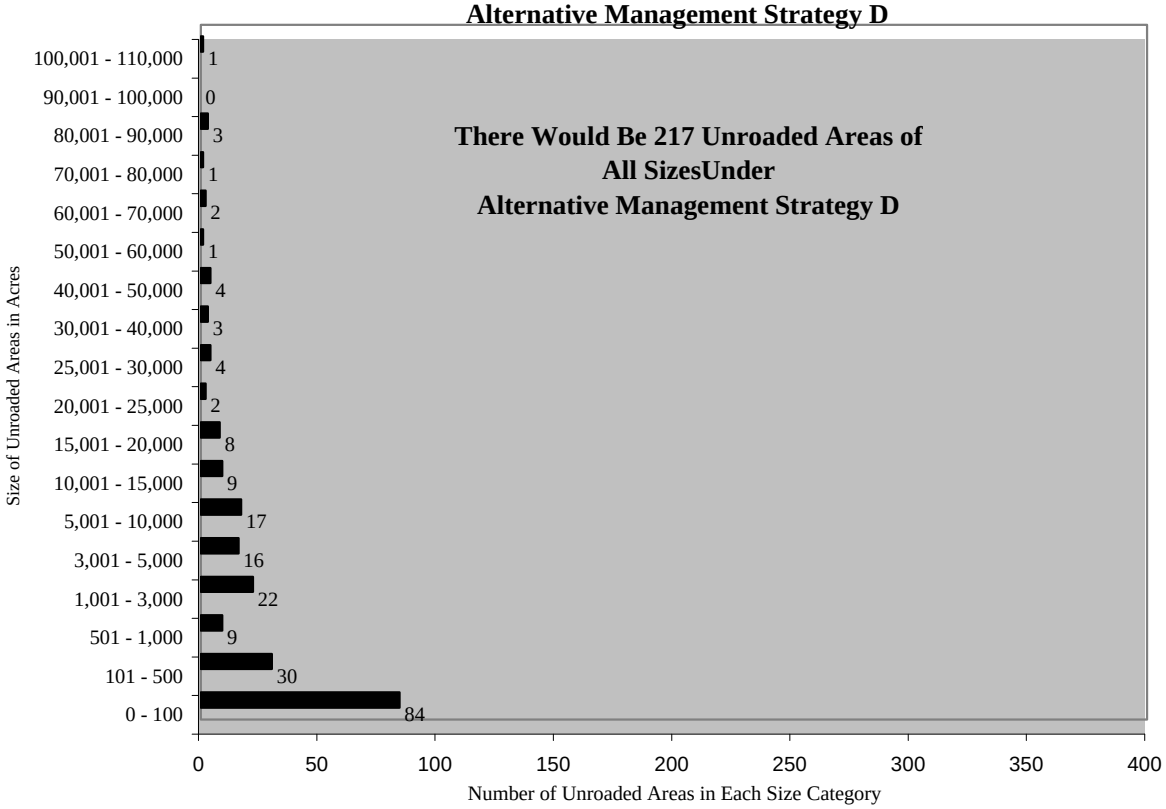


Range-wide Number of Unroaded Areas
Associated with the Proposed Action
and Alternative Management Strategies
Figure 3-5

Proposed Action (Alternative Management Strategy C*)



Alternative Management Strategy D



Range-wide Number of Unroaded Areas
Associated with the Proposed Action
and Alternative Management Strategies
Figure 3-5

near Fortuna Mine, south of Wellton near the northern boundary of the BMGR, east of the Gila Mountains between the mountains and the east branch of El Camino del Diablo, Baker Tanks west of Baker Peaks, the Copper Mountains, and Tinajas Altas Mountains (see Figure 3-2). The principal road management objective of the proposed action is the elimination of redundant routes.

Only 32 miles of road currently available for general public access would be closed in BMGR—East as a result of the proposed action. This relatively low figure (10 percent of the closures proposed for BMGR—West) reflects the low existing road densities that occur in Management Unit 6, which is the principal BMGR—East area that is open to general public access (see Figure 3-1).

The range-wide elimination of 658 miles of road from the BMGR under the proposed action would reduce the surface area occupied by the remaining active roads by about one-third to an estimated 5,687 acres (assuming an average road width of 30 feet) (see Table 3-6 and Figures 3-3 and 3-4). Assuming that these closed roads return to a natural condition over the long term, the proposed action would reduce the number of unroaded areas in the BMGR of 3,000 acres or less by 67 percent from 526 to 171 (see Figure 3-5). The number of unroaded areas of 3,001 acres or more would decrease by 44 as a result of combining smaller areas into larger blocks of unroaded area. Under the proposed action, there would be 40 unroaded areas of 3,001 to 10,000 acres, 29 unroaded areas of 10,001 to 50,000 acres, and eight unroaded areas of more than 50,000 acres. The largest unroaded area would be slightly more than 102,000 acres located in BMGR—East to the west of North and South Tactical Ranges (see Figure 3-3).

3.4.4.3 Alternative Management Strategy B—Motorized Access and Unroaded Area Status

While Alternative Management Strategy B would allow for the potential development of additional roads on a case-by-case basis, the only known proposed difference between Alternative Management Strategies A and B is that Strategy B would authorize planning for the two new Cabeza Prieta NWR/Wilderness bypass roads. These bypass roads would add approximately 7 miles to the existing road inventory bringing the inventory total to 2,229 miles. Both bypass roads would be located in Management Unit 2 (see Figure 3-2).

The effect of Management Strategy B on unroaded area conditions would be small. Strategy B would create one additional unroaded area in each of the 101- to 500-acre, 1,001- to 3,000-acre, and 3,001- to 5,000-acre categories, but would do so at the expense of eliminating an unroaded area from the 5,001- to 10,000-acre category (see Figures 3-2, 3-4, and 3-5).

If combined with the proposed action, the option of potentially developing the two Cabeza Prieta NWR/Wilderness bypass roads would eventually result in the creation of 250 unroaded areas of all sizes within the BMGR as opposed to the 248 unroaded areas that would occur with the proposed

action alone. The effect of implementing the bypass roads option would be the same as Alternative Management Strategy B; one additional unroaded area in each of the 101- to 500-acre, 1,001- to 3,000-acre, and 3,001- to 5,000-acre categories at the expense of eliminating an unroaded area from the 5,001 to 10,000 acre category (see Figures 3-2, 3-4, and 3-5).

3.4.4.4 Alternative Management Strategy D—Motorized Access and Unroaded Area Status

Alternative Management Strategy D would reduce the inventory of active roads by 765 miles to 1,457 miles, which would be about 34 percent less than the existing network, with decreases of about 46 and 25 percent in BMGR—West and BMGR—East, respectively (see Table 3-6). Under Strategy D, 554 miles of roads would be available for general public access , which is 419 miles or about 43 percent less than that available under existing conditions. The majority of the reduction in available general public access road mileage under Strategy D would again occur in BMGR—West where almost 92 percent (or 384 miles) of the decrease would occur. The pattern of road closures that would affect general public access in BMGR—West would be 64 miles more than that which would occur under the proposed action (see Table 3-6 and Figure 3-2).

There would be little difference in the effects of Alternative Management Strategy D and the proposed action on the road mileage available for general public access in BMGR—East. Strategy D would close 35 miles of public access roads compared to 32 miles under the proposed action, which is about 17 and 16 percent, respectively, of the mileage available under the existing conditions. Approximately 3 miles of general public access road would be closed in the Bender Springs area of Management Unit 7 under Strategy D and the remaining 32 miles would be closed in Management Unit 6.

The elimination of 765 miles of road from the range under Management Strategy D would reduce the surface area occupied by the remaining active roads by about 34 percent to approximately 5,298 acres (assuming an average road width of 30 feet) (see Table 3-6 and Figures 3-3 and 3-4). Over time, Strategy D would reduce the number of unroaded areas in the BMGR of 3,000 acres or less by about 72 percent from 526 to 145 (see Figure 3-5). Under Strategy D, there would be 33 unroaded areas of 3,001 to 10,000 acres, 30 unroaded areas of 10,001 to 50,000 acres, and eight unroaded areas of more than 50,000 acres. Like the proposed action, the largest unroaded area would be about 102,000 acres located in BMGR—East (see Figure 3-3).

3.4.5 Preferred Alternative

The preferred alternative is the proposed action, as described in Section 3.4.2 and presented in Tables 3-3 and 3-5.

3.5 ALTERNATIVES CONSIDERED BUT NOT CARRIED FORWARD IN DETAIL

As noted, many potential alternatives could be proposed for BMGR management over the next 25 years. Based on input received during public scoping and the two public workshops, the Core Planning Team found that the proposed action and the four alternative management strategies presented in Table 3-3 represent a reasonable range of alternatives.

Consideration was given, however, to developing two additional alternatives; one would provide more public access and use opportunities than are represented by Alternative Management Strategy B and the other would emphasize resource conservation and restrictions on public access and use beyond those described in Management Strategy D. Both of these alternative concepts were eliminated from detailed consideration because each one failed to meet certain selection criteria (see Table 3-2).

An alternative designed to increase public access and use opportunities on the BMGR beyond those offered by Alternative Management Strategy B would have to either increase the proportion of the range available for public access or expand the road network within those areas currently open to general public access. As shown in Figure 2-4, approximately 38 percent (or about 653,825 acres) of the range area supports military missions that are compatible with general public access and recreation activities on a routine basis. Opening additional areas of the range to general public access would be in direct conflict with the selection criteria that require each alternative to support the military mission. Opening additional areas of the range to general public access would:

- Result in a net loss in the capability of the BMGR to support its military purposes by placing members of the public in locations that would require curtailment in munitions delivery training missions or other operations in order to protect public safety—a conflict with Selection Criterion 1.1

- Fail to maintain the flexibility of the range to support future military missions by encumbering additional range land areas with incompatible non-military land use—a conflict with Selection Criterion 1.2

- Fail to protect the mutual safety of the public and military personnel by providing public access to weapons ranges where there would be an increased risk of scheduling conflicts that would expose members of the public to munitions delivery activities—a conflict with Selection Criterion 1.3

- Potentially reduce the opportunities to maintain, improve, or restore environmental conditions that would support the military purposes of the range because of potential increased impacts from public access—a conflict with Selection Criterion 1.4

- Fail to prevent interference with the military purposes of the range from non-military land use by authorizing public access to locations where it is incompatible with ongoing military activities—a conflict with Selection Criterion 1.5

- Interfere with military purposes of the range by creating the need for additional natural or cultural resource management activities to address the environmental effects of public access within weapons ranges and other exclusive military operating areas—a conflict with Selection Criterion 1.6

The extent to which an alternative that would emphasize increasing public access and use opportunities on the BMGR would be in conflict with the selection criteria for natural and cultural resource protection, conservation, and rehabilitation cannot be determined at this time. The effects of the existing levels of public access and use on the ecosystem and biodiversity of the BMGR can only be determined through multi-year monitoring programs specifically designed to measure the health of this ecosystem and its resiliency for enduring various levels of use. One of the goals of the proposed INRMP is to establish the ecosystem/biodiversity monitoring programs required to make these types of determinations. Therefore, consideration of an alternative that emphasizes increased public access and use before the necessary monitoring information is available to fully assess the potential impacts of such an alternative is not regarded as a prudent management option. Consideration of a management emphasis to increase public access and use opportunities may be appropriate at some future point once the new BMGR management program is established and needed monitoring information is available. Such a management emphasis may be adopted during one of the future required five-year update cycles for the INRMP once it is implemented, but was not considered within the reasonable range of alternatives for the proposed INRMP.

An alternative that emphasizes resource protection and conservation at a level exceeding that represented in Alternative Management Strategy D was also not considered to be within the reasonable range of alternatives for the proposed INRMP. Some comments received from the public on this issue suggested that the proposed INRMP should emphasize levels of natural resource preservation commensurate with that of wilderness, national park, or wildlife refuge management. The MLWA of 1999 and the Sikes Act—as well as DoD, Air Force, and Marine Corps policies and regulations—require that the proposed INRMP emphasize ecosystem management principles and biodiversity conservation. However, these laws, policies, and regulations do not require levels of resource preservation on DoD installations that would preclude public access that is otherwise compatible with the military missions and ecosystem sustainability (DoD Instruction 4715.3 at Paragraph 4.1.4). Alternative Management Strategy D was designed to provide the maximum emphasis that could be placed on resource protection and conservation consistent with the military purposes of the BMGR and requirements to provide public access consistent with the military mission and ecosystem sustainability. An alternative that would emphasize environmental preservation management in excess of the level of resource protection

and conservation represented in Strategy D was considered to be inconsistent with the selection criteria that require that each alternative must:

- Result in no net loss in the capability of the range to support the military purposes for which it was established (Selection Criterion 1.1)
- Maintain the flexibility of the range to support future military missions (Selection Criterion 1.2)
- Prevent non-military land use that would interfere with the military purposes of the range (Selection Criterion 1.5)
- Avoid discretionary natural or cultural resource management activities that would interfere with the military purposes of the range (Selection Criterion 1.6)
- Provide for sustainable multipurpose public use of the BMGR to the extent consistent with its military purposes (Selection Criterion 3.1)
- Provide for sustainable multipurpose public use of the BMGR to the extent that the use is consistent with the needs of wildlife resources (Selection Criterion 3.2)
- Make the BMGR available to public use when access is compatible with ecosystem sustainability (Selection Criterion 3.3)

3.6 COMPARISON OF THE PROPOSED ACTION AND ALTERNATIVES

Table 3-14 compares the primary effects of the proposed action to Alternative Management Strategies A, B, C, and D.

TABLE 3-14
COMPARISON OF ALTERNATIVES

Proposed Action	Strategy A	Strategy B	Strategy C	Strategy D
Earth Resources				
Proposed Action	**Strategy A**	**Strategy B**	**Strategy C**	**Strategy D**
• Restricts or limits some uses that can cause physical disturbance and associated soil erosion (e.g., ORV travel, motorized public access, vehicle-based camping, utility/transportation corridor development), which would generally reduce physical soil impacts compared to current conditions at low levels range wide, with greater levels of improvement possible in localized areas. Includes reduced effects to soils from road network and associated uses (e.g., vehicle-based camping) by closing 658 miles of roads. The estimated upper limit of the total BMGR surface area occupied by roads and shoulder areas would be reduced from 0.47 percent to 0.33 percent.	• Some of the same impacts as the proposed action, but cumulative physical disturbance to soils would likely be slightly greater because of fewer restrictions or limitations on some uses that can disturb soils and cause accelerated rates of erosion (e.g., ORV travel, motorized public access, vehicle-based camping, utility/transportation corridor development). Includes continued effects to soils from the existing 2,222-mile road network and associated uses in short term. Future development of a transportation plan could decrease physical disturbance from roads and shoulder areas by an unquantified amount in long term.	• Some of the same impacts as the proposed action, but cumulative physical disturbance to soils would potentially be greater because of fewer restrictions or limitations on some uses (e.g., ORV travel, motorized public access, vehicle-based camping, utility/transportation corridor development) and potential for new uses that can disturb soils and cause accelerated rates of erosion (e.g., designated ORV use areas, vehicle-based camping within 100 feet instead of 50 feet of open roads). Includes continued effects to soils from an estimated 2,229-mile road network (includes 7-mile Cabeza Prieta NWR bypass roads) and associated uses and potentially by new roads. The estimated upper limit of the total BMGR surface area occupied by roads and shoulder areas would continue to be about 0.47 percent to the total range acreage.	• Differs minimally from the proposed action in terms of restrictions or limitations on uses that could cause physical disturbance and associated soil erosion. As with the proposed action, includes reduced effects to soils from road network and associated uses (e.g., vehicle-based camping) by closing 658 miles of roads. The estimated upper limit of the total BMGR surface area occupied by roads and shoulder areas would be reduced from 0.47 percent to 0.33 percent.	• Proposes greater restrictions/limitations on some uses (e.g., motorized public access, utility/transportation corridor development) and would result in slightly less physical disturbance on a range-wide basis than proposed action, correlating to slightly lower intensity effects on soil resources. Includes reduced effects to soils from road network and associated uses by closing about 765 miles of road. The estimated upper limit of the total BMGR surface area occupied by roads would be reduced from 0.47 percent to 0.31 percent.
• Limits of acceptable change monitoring would provide data needed to trigger adaptive management responses that could benefit soil resources (e.g., to curtail illicit off-road driving)	• No monitoring-related soil resources management	• Monitoring limited to compliance actions, with fewer benefits to soil resources expected than with the proposed action	• Limits of acceptable change monitoring would provide data needed to trigger adaptive management responses that could benefit soil resources (e.g., to curtail illicit off-road driving)	• Limits of acceptable change monitoring would provide data needed to trigger adaptive management responses that could benefit soil resources (e.g., to curtail illicit off-road driving)
• Continues existing earth resources management objectives, *plus* implements new management objectives for soil and water resources management that would provide better information to be used in management	• Retains existing earth resources management provisions, which includes fewer earth resources management objectives than the proposed action	• Focuses on complying with statutory requirements and preventing erosion in areas of cultural resource sensitivity, a lower level of management of earth resources than the proposed action	• Similar to the proposed action, but slightly less comprehensive monitoring and perimeter land use coordination than with the proposed action and slightly higher management standards for air and visual resources would potentially have minor mixed effects on earth resources	• Similar to the proposed action, but with higher management standards for air resources and visual resources that could indirectly lessen indirect effects on earth resources to a minor degree
• Includes a range-wide soil survey	• Does not include a range-wide soil survey	• Does not include a range-wide soil survey	• Does not include a range-wide soil survey	• Includes a range-wide soil survey
• Areas of excessive surface damage would be restored where feasible and prudent, reducing effects to soils in affected areas	• No prescribed restoration efforts	• No prescribed restoration efforts	• No prescribed restoration efforts	• Closed roads and areas of excessive surface damage would be restored where feasible, reducing effects on soils in localized areas
Water Resources				
Proposed Action	**Strategy A**	**Strategy B**	**Strategy C**	**Strategy D**
• Reductions in physical surface disturbance (as described under earth resources for this strategy) would potentially decrease associated effects to water resources, such as disruption of natural stormwater runoff patterns and increased sediment in water courses	• Slightly higher levels of physical surface disturbance than under the proposed action (as described under earth resources for this strategy) would potentially result in greater effects to water resources, such as disruption of natural stormwater runoff patterns and increased sediment in water courses. Future development of a transportation plan could lead to reductions in road-related surface disturbance of an unquantified amount.	• Slightly higher levels of cumulative physical surface disturbance than under the proposed action (as described under earth resources for this strategy) would likely result in slightly greater effects to water resources, such as disruption of natural stormwater runoff patterns and increased sediment in water courses	• Reductions in physical disturbance (as described under earth resources for this strategy) would potentially decrease any associated effects to water resources, such as disruption of natural stormwater runoff patterns and increased sediment in water courses	• Reductions in physical disturbance as described under earth resources for this strategy) would potentially decrease any associated effects to water resources, such as disruption of natural stormwater runoff patterns and increased sediment in water courses
• Additional resource inventory and monitoring objectives and a shift to adaptive management with regard to all resource management objectives could potentially identify and lessen impacts to water resources	• Continued management under existing guidance and fewer resource inventory and monitoring objectives would have less potential for reducing impacts to water resources than the proposed action	• Less extensive inventory and monitoring and soil and water resources management programs would have less potential for reducing impacts to water resources than the proposed action	• Similar to the proposed action, but excludes ecosystem-wide efforts for resource inventory and monitoring and includes air and visual resource objectives that could indirectly lessen impacts on water resources	• Same level of resource inventory and monitoring as proposed action, but includes higher management standards for air resources and visual resources that could indirectly lessen impacts on water resources
Climate and Air Resources				
Proposed Action	**Strategy A**	**Strategy B**	**Strategy C**	**Strategy D**
• Not expected to have any measurable or long-term impact on range-wide air quality	• Not expected to have any measurable or long-term impact on range-wide air quality	• Not expected to have any measurable or long-term impact on range-wide air quality	• Not expected to have any measurable or long-term impact on range-wide air quality	• Not expected to have any measurable or long-term impact on range-wide air quality
• Proposed changes in vehicular use and other activities that may influence air quality, including continuing existing management objectives for air resources management, would potentially have minor, short-term and localized, mixed effects on air resources	• Future development of a transportation plan and continued limitations or restrictions on other activities that may influence air quality, including continuing existing management objectives for air resources, would potentially have minor, short-term and localized, mixed effects on air resources	• Less restrictive measures on vehicle use and recreational activities (including potential designation of ORV use areas) and no special management objectives to avoid air quality degradation could have greater impacts on short-term and localized air quality than proposed action	• Mixed effects to air quality similar to the proposed action, but potential use of dust palliatives on heavily traveled roads could result in greater localized reductions in fugitive dust emissions	• Mixed effects to air quality similar to the proposed action, but potential use of dust palliatives on heavily traveled roads could result in greater localized reductions in fugitive dust emissions

TABLE 3-14
COMPARISON OF ALTERNATIVES

General Vegetation				
Proposed Action	**Strategy A**	**Strategy B**	**Strategy C**	**Strategy D**
• Continued and new limitations or restrictions on motorized access, visitor camping, and public use would generally reduce low-level, dispersed impacts to vegetation range-wide, with greater reductions possible in some localized areas. Includes: ▪ 658 miles of road closures (resulting in a 1,564-mile total road network), which would not only result in reduced impacts from the roads, but also other associated activities; the majority of road closures (550 miles) would be within the creosotebush-bursage desertscrub natural community ▪ continuing to prohibit visitor off-road driving, retaining a minimum of six law enforcement personnel, and increased user education ▪ restrictions on camping and visitor stay limits (including decreased vehicle-based camping locations as a result of road closures and restrictions in areas with sensitive resources), rockhounding, recreational shooting, wood cutting and gathering, native wood campfires in Unit 1, collection of native plants, and further possible restrictions based on assessments of special hunting program, non-game species collection, recreational shooting, and designated camping areas	• Continuing the current limitations or restrictions on motorized access, visitor camping, and public use would not change the existing potential for low-level, dispersed impacts to vegetation at low levels range-wide or more intense impacts in some localized areas. Includes: ▪ keeping entire 2,222-mile road network open to vehicle use and associated activities ▪ continuing to prohibit visitor off-road driving, not requiring a minimum number of law enforcement personnel, and providing user education ▪ restrictions on camping and visitor stay limits, rockhounding, wood cutting and gathering (the continued prohibition of use and collection of dead and downed wood within the expired ACECs and within 150 feet of the expired Backcountry Byway), and collection of native plants	• Continuing the current limitations or restrictions on motorized access, visitor camping, and public use would not reduce the existing potential for low-level, dispersed impacts to vegetation range-wide or more intense impacts in some localized areas. Includes: ▪ retaining entire 2,222-mile road network open to existing vehicle use and associated activities ▪ continuing to prohibit off-road driving, requiring a minimum of two law enforcement personnel, and providing user education ▪ restrictions on camping and visitor stay limits, rockhounding, wood cutting and gathering (the continued prohibition of use and collection of dead and downed wood within the expired ACECs and within 150 feet of the Backcountry Byway), and collection of native plants • Potential for some increased impacts to vegetation as compared to the proposed action and existing conditions from retaining current 2,222-mile road network, plus potentially the 7-mile Cabeza Prieta NWR bypass roads and other new public use roads, and extending vehicle use to designated washes	• Continued and new vegetation based on limitations or restrictions on motorized access, visitor camping, and public use would generally reduce the level or extent of human-induced impacts low-level, dispersed impacts to vegetation range-wide, with greater levels of reduction possible in some localized areas. Includes: ▪ 658 miles of road closures (resulting in a 1,564-mile total road network), which would not only result in reduced impacts from the roads, but also other associated activities; the majority of road closures (550 miles) would be within the creosotebush-bursage desertscrub natural community ▪ continuing to prohibit visitor off-road driving, requiring a minimum of four law enforcement personnel, and increased user education ▪ restrictions on camping and visitor stay limits (including decreased vehicle-based camping from road closures and restrictions in areas with sensitive resources), rockhounding, recreational shooting, wood cutting and gathering, collection of native plants, and further possible restrictions based on assessments of special hunting program, non-game species collection, recreational shooting, and designated camping areas	• Continued and new limitations or restrictions on motorized access, visitor camping, and public use would generally reduce low-level, dispersed impacts to vegetation range-wide, with greater levels of reduction possible in some localized areas. Includes: ▪ 765 miles of road closures (resulting in a 1,457-mile total road network), mostly within the creosotebush-bursage desertscrub natural community, wherein an estimated 630 miles of road would be closed, which would not only result in reduced impacts from the roads, but also other associated activities ▪ recreation services and use supervision, including continuing to prohibit visitor off-road driving, requiring a minimum of six law enforcement personnel, and increased user education ▪ restrictions on camping and visitor stay limits (including decreased vehicle-based camping from road closures and restrictions in areas with sensitive resources), collection of native plants, and further possible restrictions based on assessments of special hunting program, and designated camping areas ▪ prohibiting rockhounding, recreational shooting, all wood cutting and gathering and native wood campfires, and non-game species collection (within the authority of state law)
• If general recreational shooting and/or camping areas were established, there may be more intense localized impacts to vegetation, but less dispersed impacts from these activities	• Effects on vegetation from recreational shooting/camping would continue to be dispersed as there would be no evaluation of establishing designated areas for these activities	• If designated camping areas were established, there may be more localized impacts to vegetation, but less dispersed impacts from camping; if a designated ORV use area were established, there could be localized destruction of vegetation	• If designated shooting and/or camping areas were established, there may be more intense localized impacts to vegetation, but less dispersed impacts from these activities	• If designated camping areas were established, there may be more intense localized impacts to vegetation, but less dispersed impacts from these activities
• General vegetative resources would be considered in a broader, regional context, and a more adaptive, ecosystem management approach would be taken towards stewardship, including improved coordination with other land owners/managers; maintenance of existing, or establishment of additional special management provisions for protection of vegetation; and increased monitoring, surveying and mapping efforts to provide reliable and up-to-date scientific information about vegetative resources and their response to ongoing military and civilian use on the BMGR and within the greater ecoregion. Redesignation of HMA and ACECs may promote enhanced protection of vegetation communities within these special natural/interest areas.	• Management of vegetative resources would be limited to the actions prescribed in the Goldwater Amendment, HMPs, or compliance-related requirements. Redesignation of all special management areas and applicable management provisions may promote enhanced protection of vegetation communities within areas.	• Management of vegetative resources would be somewhat expanded from existing programs to include means to monitor compliance action, invasive species management programs, and the restoration of areas damaged by discontinued use. Enhanced protection of vegetation communities associated with special natural/interest area designation would be limited to that associated with the HMA.	• Management of vegetative resources similar to the proposed action, but includes less coordination with other land owners/managers and additional visual and air resources management objectives that would have minor indirect mixed effects on vegetation management as compared to the proposed action. Redesignation of HMA and ACECs may promote enhanced protection of vegetation communities within these special natural/interest areas.	• General vegetative resources would be considered in the broadest, regional context, and a most adaptive, ecosystem management approach would be taken towards stewardship of the alternatives considered. Redesignation of all special management areas may promote enhanced protection of vegetation communities within an expanded aggregate area of special natural/interest areas.
• Unroaded areas greater than 3,000 acres would be conserved as compatible with military or agency missions, precluding or reducing impacts to plants and natural communities in these areas	• Unroaded areas would exist, but does not include an objective for unroaded area conservation	• Unroaded areas would exist, but does not include an objective for unroaded area conservation	• Unroaded areas greater than 3,000 acres would be conserved as compatible with military and agency missions, precluding or reducing impacts to plants and natural communities in these areas	• Unroaded areas greater than 3,000 acres would be conserved as compatible with military and agency missions, precluding or reducing impacts to plants and natural communities in these areas
• No augmented restoration of closed roads proposed, but vegetation restoration efforts would be implemented in areas that have been damaged by a discontinued military, agency, or intensive public use	• No roads proposed for closure in short term; no prescribed restoration	• No roads proposed for closure, vegetation restoration efforts would be implemented for areas that have been damaged by a discontinued military, agency, or intensive public use	• No augmented restoration of closed roads proposed, but vegetation restoration efforts would be implemented for areas that have been damaged by discontinued military, agency, or intensive public use	• Implementation of augmented restoration/remediation of closed roads (where feasible) and vegetation restoration efforts for areas that have been damaged by a discontinued military, agency, or intensive public use

TABLE 3-14
COMPARISON OF ALTERNATIVES

General Wildlife and Wildlife Habitats				
Proposed Action	**Strategy A**	**Strategy B**	**Strategy C**	**Strategy D**
• Continued and new limitations or restrictions on motorized access, visitor camping, and public use would generally reduce low-level, dispersed impacts on general wildlife and wildlife habitat range-wide, with greater reductions possible in some localized areas. Additionally: ▪ prohibiting recreational entry to mines would protect roosting bats from disturbance ▪ minor direct effects, such as injury or disturbance, to wildlife species from vehicle use, noise, camping, and wood collection would be reduced, particularly for valley bottom-dwelling and foraging species, as roads and associated activities would be most limited/reduced in these areas ▪ potential elimination of non-game species collection could reduce impacts on the target species and collateral damage to non-target species	• Continuing the current limitations or restrictions on motorized access, visitor camping, and public use would leave the existing potential for low-level dispersed impacts on general wildlife and wildlife habitats unchanged. Additionally: ▪ continuing to prohibit recreational entry to mines would protect roosting bats from disturbance ▪ wildlife species would continue to be subject to existing minor levels of harm and/or disturbance from vehicle use, noise, camping, and wood collection ▪ no assessments called for that might add to or change use limitations or restrictions on non-game species collection	• Continuing the current limitations on restrictions on public/government motorized access would leave the existing potential for low-level dispersed impacts on general wildlife and wildlife habitats unchanged. Additionally: ▪ the evaluation of the feasibility for allowing public entry to mines could potentially impact bats, if such entry were approved ▪ wildlife would continue to be subject to at least existing levels of minor harm and/or disturbance from vehicle use, noise, camping, wood cutting and collection; levels of harm could potentially increase if the public access road network is expanded	• Continued and new limitations on public/government motorized access and recreation use would generally reduce low-level, dispersed impacts on general wildlife and wildlife habitat range-wide, but higher levels of impacts may occur from concentrated use in some localized areas. Additionally: ▪ prohibiting recreational entry to mines would protect roosting bats from disturbance ▪ minor direct effects, such as injury or disturbance, to wildlife species from vehicle use, noise, camping, and wood collection, may be reduced, particularly for valley bottom-dwelling and foraging species as roads and associated activities would be most limited/reduced in these areas ▪ change in types or intensity of impacts could result from the evaluation of non-game species collection and any restrictions (within the authority of state law)	• Continued and new limitations on public/government motorized access would generally reduce low-level, dispersed impacts on general wildlife and wildlife habitat range-wide, but higher levels if impacts may occur from concentrated use in some localized areas. Additionally: ▪ prohibiting recreational entry to mines would protect roosting bats from disturbance ▪ minor direct effects, such as injury or disturbance to wildlife species from vehicle use, noise, camping, and wood collection may be reduced to a slightly greater degree than with the proposed action, particularly for valley bottom-dwelling and foraging species as roads and associated activities would be most limited/reduced in these areas ▪ minor effects that could be reduced or eliminated through the prohibition of recreational shooting, rockhounding, and non-game species collection (within the authority of state law)
• If designated recreational shooting and/or camping areas were established, there may be more intense localized impacts to wildlife and wildlife habitat, but less dispersed impacts from these activities	• Effects on wildlife and wildlife habitat from recreational shooting/camping would continue to be dispersed as there would be no evaluation of establishing designated areas for these activities	• If designated camping areas were established, there may be more intense localized impacts to wildlife and wildlife habitat, but less dispersed impacts from camping • If a designated ORV use area were established, there could be localized destruction of wildlife habitat and injury/death of individual animals	• If designated shooting and/or camping areas were established, there may be more intense localized impacts to wildlife and wildlife habitat, but less dispersed impacts from these activities	• If designated camping areas were established, there may be more intense localized impacts to wildlife and wildlife habitat, but less dispersed impacts from these activities
• The shift toward ecosystem management approaches, as described for General Vegetation for this strategy, may result in management based on a broader range of wildlife species, including the species conservation elements that are intended to serve as indicators of biodiversity and ecosystem health	• Continued management based largely on special status and game species programs would not include an increased emphasis on ecosystem management principals and biodiversity conservation, as compared to the proposed action	• Management based largely on compliance requirements would be largely limited to special status species programs, rather than overall ecosystem management principals and biodiversity conservation, as with the proposed action	• The shift toward ecosystem management approaches, as described for General Vegetation for this strategy, may result in management based on a broader range of wildlife species, including the species conservation elements that are intended to serve as indicators of biodiversity and ecosystem health	• The shift toward ecosystem management approaches, as described for General Vegetation for this strategy, may result in management based on a broader range of wildlife species, including the species conservation elements that are intended to serve as indicators of biodiversity and ecosystem health
• The approach to wildlife water developments would limit new developments in the first five years of the INRMP to six high-priority waters (of the 17 developments proposed in the HMPs and not yet implemented, 14 are primarily for the benefit of desert bighorn sheep, two are primarily for the benefit of mule deer, and one is primarily for the benefit of Sonoran pronghorn); concurrently, literature research and studies would be conducted to further understand the beneficial and adverse effects of wildlife water developments; future management of wildlife waters would be dependent upon findings	• Up to 17 new wildlife waters could be developed during the term of the INRMP, but it is unlikely that more than six would be developed during the first five years of the INRMP; thus, during the near term, the difference between this strategy in the proposed action is that literature review and studies (called for under the proposed action) would not be conducted	• More than 17 new wildlife waters could be developed during the term of the INRMP, but it is unlikely that more than six would be developed during the first five years of the INRMP; thus, during the near term, the difference between this strategy in the proposed action is that the literature review and studies called for under the proposed action) would not be conducted	• The approach to wildlife water developments would be the same as the proposed action; wildlife water developments would be limited to six high-priority waters during the first five years of the INRMP; concurrently, literature research and studies would be conducted to further understand the beneficial and adverse effects of wildlife water developments; future management of wildlife waters would be dependent upon findings	• New wildlife water developments would be suspended for the first five years of the INRMP and, during that time period, literature research and studies would be conducted on the beneficial and adverse effects of wildlife water developments; future management of wildlife waters would be dependent upon findings
• Conservation of unroaded areas would preclude or reduce impacts to resident and transient wildlife in these areas	• There would be no objective for conservation of unroaded areas	• There would be no objective for conservation of unroaded areas	• Conservation of unroaded areas would potentially preclude or reduce impacts to resident and transient wildlife in these areas	• Conservation of unroaded areas would potentially preclude or reduce impacts to resident and transient wildlife in these areas
• No augmented restoration of closed roads proposed, but wildlife habitat restoration efforts would be implemented for areas that have been damaged by a discontinued military, agency, or intensive public use	• No roads proposed for closure in short term; no prescribed restoration	• No roads proposed for closure, vegetation restoration efforts would be implemented for areas that have been damaged by a discontinued military, agency, or intensive public use	• No augmented restoration of closed roads proposed, but wildlife habitat restoration efforts would be implemented for areas that have been damaged by a discontinued military, agency, or intensive public use	• Implementation of augmented restoration/remediation of closed roads (where feasible) and wildlife habitat restoration efforts for areas that have been damaged by a discontinued military, agency, or intensive public use

TABLE 3-14
COMPARISON OF ALTERNATIVES

Protected Species				
Proposed Action	**Strategy A**	**Strategy B**	**Strategy C**	**Strategy D**
• Continued and new limitations on motorized access, visitor camping, and public use would generally reduce the potential for low-level, dispersed impacts on protected/special status animal or plant species and, for wildlife habitat; potential extent of these reductions would vary depending on the distribution of the individual species relative to the specific areas affected by the proposed road closures or other access limitations	• Continuing the current limitations on motorized access, visitor camping, and public use would leave the existing potentials for low-level dispersed impacts on protected/special status species unchanged	• Continuing the current limitations on motorized access, visitor camping, and public use would leave the existing potentials for low-level dispersed impacts on protected/special status species unchanged	• Continued and new limitations on motorized access, visitor camping, and public use would generally reduce the potential for low-level, dispersed impacts on protected/special status animal or plant species and, for wildlife habitat; potential extent of these reductions would vary depending on the distribution of the individual species relative to the specific areas affected by the proposed road closures or other access limitations	• Continued and new limitations on motorized access, visitor camping, and public use would generally reduce the potential for low-level, dispersed impacts on protected/special status animal or plant species and, for wildlife habitat; potential extent of these reductions would vary depending on the distribution of the individual species relative to the specific areas affected by the proposed road closures or other access limitations
• The application of ecosystem management principals would favor conservation of BMGR natural communities in which protected/special status species are components and upon which they depend for survival	• Protected/special status species management would not be augmented by an increased emphasis on ecosystem management principals or transboundary management coordination	• Protected/special status species management would not be augmented by an increased emphasis on ecosystem management principals or transboundary management coordination	• The application of ecosystem management principals would favor conservation of BMGR natural communities in which protected/special status species are components and upon which they depend for survival	• The application of ecosystem management principals would favor conservation of BMGR natural communities in which protected/special status species are components and upon which they depend for survival
• Improved transboundary coordination with land managers/owners outside the BMGR would facilitate ecoregional management efforts and enhance protected/special status species management			• Improved transboundary coordination with land managers/owners outside the BMGR would facilitate ecoregional management efforts and enhance protected/special status species management	• Improved transboundary coordination with land managers/owners outside the BMGR would facilitate ecoregional management efforts and enhance protected/special status species management
• An estimated 125 miles of roads within the current active range of the Sonoran pronghorn would be closed, which is consistent with the current Marine Corps and Air Force biological opinions for Sonoran pronghorn	• No road closures proposed within the current active range of the Sonoran pronghorn, which is inconsistent with the current Marine Corps and Air Force biological opinions and would leave the potential for vehicle use to affect these animals or their habitat unchanged	• No road closures proposed within the current active range of the Sonoran pronghorn, which is inconsistent with the current Marine Corps and Air Force biological opinions and would leave the potential for vehicle use to affect these animals or their habitat unchanged	• An estimated 125 miles of roads within the current active range of the Sonoran pronghorn would be closed, which is consistent with the current Marine Corps and Air Force biological opinions for Sonoran pronghorn	• An estimated 174 miles of roads within the current active range of the Sonoran pronghorn would be closed, which is consistent with the current Marine Corps and Air Force biological opinions for Sonoran pronghorn
• An estimated 67 miles of roads within flat-tailed horned lizard habitat would be closed which would reduce the potential for these animals to be killed by vehicle use	• No road closures within flat-tailed horned lizard habitat would have potential for these animals to be killed by vehicle use unchanged	• No road closures proposed within flat-tailed horned lizard habitat would have potential for these animals to be killed by vehicle use unchanged	• An estimated 67 miles of roads within flat-tailed horned lizard habitat would be closed, which would reduce the potential for these animals to be killed by vehicle use	• An estimated 69 miles of roads within flat-tailed horned lizard habitat would be closed, which would reduce the potential for these animals to be killed by vehicle use
• Continuing to prohibit recreational entry to mines would continue to protect California leaf-nosed and lesser long-nosed bats from disturbance	• Continuing to prohibit recreational entry to mines would continue to protect lesser long-nosed and California long-nosed bats from disturbance	• Continuing to prohibit recreational entry to mines would continue to protect lesser long-nosed and California leaf-nosed bats from disturbance; potential impacts to these species from public use of mine shafts could occur if sanctioned in the future, although sites would be evaluated for compatibility with public entry	• Continuing to prohibit recreational entry to mines would continue to protect California leaf-nosed and lesser long-nosed bats from disturbance	• Continued prohibited entry to mines would continue to protect California leaf-nosed and lesser long-nosed bats from disturbance
• Implementing site-specific actions (e.g., designating camping or recreational shooting areas, creating the Cabeza Prieta NWR bypass road, etc.) could have potential impacts on protected species, which would be evaluated and mitigated as appropriate in site-specific NEPA evaluation/ Endangered Species Act compliance	• Implementing site-specific actions could have potential impacts on protected/special status species, which would be evaluated and mitigated as appropriate in site-specific NEPA evaluation/ Endangered Species Act compliance	• Implementing site-specific actions (e.g., creating the Cabeza Prieta NWR bypass road, etc.) could have potential impacts on protected/special status species, which would be evaluated and mitigated as appropriate in site-specific NEPA evaluation/ Endangered Species Act compliance	• Implementing site-specific actions (e.g., designating camping or recreational shooting areas, creating the Cabeza Prieta NWR bypass road, etc.) could have potential impacts on protected/special status species, which would be evaluated and mitigated as appropriate in site-specific NEPA evaluation/ Endangered Species Act compliance	• Implementing site-specific actions (e.g., designating camping areas) could have potential impacts on protected/special status species, which would be evaluated and mitigated as appropriate in site-specific NEPA evaluation/ Endangered Species Act compliance
Wildfire Management				
Proposed Action	**Strategy A**	**Strategy B**	**Strategy C**	**Strategy D**
• Increased surveys/studies, plans, and coordination would provide up-to-date information about ecological conditions that could be used in wildfire management planning	• Fewer studies, evaluations, and actions than proposed action, resulting in less information for wildfire management	• Fewer studies, evaluations, and actions for understanding ecological conditions than the proposed action, but includes vegetation surveys, which would be useful for wildfire management	• Slightly fewer resource monitoring activities than the proposed action, but would provide improved information on vegetation community conditions, which would be useful for wildfire management planning	• Increased surveys/studies, plans, and coordination would provide up-to-date information about ecological conditions that could be used in wildfire management planning
• Development of a wildfire management plan would facilitate fire hazard management	• No prescribed wildfire management plan	• Wildfire management plan would facilitate fire hazard management	• Development of a wildfire management plan would facilitate fire hazard management	• Development of a wildfire management plan would improve interagency coordination and facilitate fire hazard management

Wildfire Management (continued)				
Proposed Action	**Strategy A**	**Strategy B**	**Strategy C**	**Strategy D**
• Wildfire prevention would be enhanced by management activities that decrease invasive plant proliferation; provide the highest minimum law enforcement positions (six), which increases patrol activities with the associated potential to detect fire hazards; and emphasize transboundary land management/ownership coordination, which could reduce fire hazards	• Continues existing wildfire management focus on the suppression of wildfires with the lowest acreage loss and in the most cost-efficient manner	• Provides for minimal perimeter land use coordination and minimum of two law enforcement positions, potentially reducing opportunities to prevent wildfire compared to proposed action	• Wildfire prevention would be somewhat enhanced by management activities that would decrease invasive plant proliferation; provide a minimum of four law enforcement positions, which would increase patrol activities with the associated potential to detect fire hazards; and increase emphasis on transboundary land management/ownership coordination, which could reduce fire hazards	• Wildfire prevention would be enhanced by management activities that decrease invasive plant proliferation; provide the highest minimum law enforcement positions (six), which increases patrol activities with the associated potential to detect fire hazards; and emphasize transboundary land management/ownership coordination which could reduce fire hazards
Grounds Maintenance				
Proposed Action	**Strategy A**	**Strategy B**	**Strategy C**	**Strategy D**
• Could potentially change grounds maintenance procedures as a result of implementing a fire management plan, developing invasive species control procedures, determining that a change is needed to reduce impacts on sensitive biological resource (such as pest management activities affecting flat-tailed horned lizards)	• Could potentially change grounds maintenance procedures if pest management activities were determined to be affecting the flat-tailed horned lizards, another sensitive species; lack of monitoring could mean potential problem areas would not be identified	• Could potentially change grounds maintenance procedures as a result of implementing a fire management plan, developing invasive species control procedures, determining that a change is needed to reduce impact on sensitive biological resource (such as pest management activities affecting flat-tailed horned lizards)	• Could potentially change grounds maintenance procedures as a result of implementing a fire management plan, developing invasive species control procedures, determining that a change is needed to reduce impact on sensitive biological resource (such as pest management activities affecting flat-tailed horned lizards)	• Could potentially change grounds maintenance procedures as a result of implementing a fire management plan, developing invasive species control procedures, determining that a change is needed to control impact on sensitive biological resource (such as pest management activities affecting flat-tailed horned lizards)
Public Utilities and Transportation Corridors				
Proposed Action	**Strategy A**	**Strategy B**	**Strategy C**	**Strategy D**
• Allows development of Yuma Area Service Highway, but no other new corridors • Future transportation projects would be restricted to the existing State Route 85 corridor or the Yuma Area Service Highway corridor, if constructed • Restricts future utility projects to the existing State Route 85 corridor	• Requires field review and/or environmental assessments for corridor proposals (would likely allow development of Yuma Area Service Highway) • Restricts future utility projects to the existing State Route 85 corridor	• Provides for consideration of new utility/transportation corridors on a case-by-case basis, if compatible with military mission (would likely allow development of Yuma Area Service Highway) • Does not restrict future utility projects to the existing State Route 85 corridor, but requires regulatory review prior to approval	• Allows development of Yuma Area Service Highway, but no other new corridors • Future transportation projects would be restricted to the existing State Route 85 corridor or the Yuma Area Service Highway corridor, if constructed • Restricts future utility projects to the existing State Route 85 corridor	• Allows development of Yuma Area Service Highway, but no other new corridors • Future transportation projects would be restricted to the existing State Route 85 corridor or the Yuma Area Service Highway corridor, if constructed • Restricts future utility projects to the existing State Route 85 corridor
Special Management Areas				
Proposed Action	**Strategy A**	**Strategy B**	**Strategy C**	**Strategy D**
• Redesignates ACECs and HMA as special natural/interest areas, but allows the SRMAs and Backcountry Byway to expire • Existing management provisions would be retained for the HMA; management of the redesignated ACECs as special natural/interest areas and the former SRMAs and Backcountry Byway would be affected by other 16 resource management elements. Additional management provisions could be implemented for the redesig-nated special natural/interest areas. The potential for altering existing or establishing additional special natural/interest areas would be evaluated.	• Redesignates existing designations for ACECs, HMA, SRMAs, and the Backcountry Byway as special natural/interest areas • Existing management provisions would be retained for all existing special management areas	• Redesignates HMA as a special natural/interest area, but allows ACECs, SRMAs, and Backcountry Byway to expire • Existing management provisions would be retained for the HMA; management of the former ACECs, SRMAs, and Backcountry Byway would be affected by other 16 resource management elements. No prescribed evaluation of altering existing or establishing additional special natural/interest areas.	• Redesignates ACECs and HMA as special natural/interest areas, but allows the SRMAs and Backcountry Byway to expire • Existing management provisions would be retained for the HMA; management of the redesignated ACECs as special natural/interest areas and former SRMAs and Backcountry Byway would be affected by other 16 resource management elements. Additional management provisions could be implemented for the redesig-nated special natural/interest areas. The potential for altering existing or establishing additional special natural/interest areas would be evaluated.	• Redesignates ACECs, HMA, SRMAs, and Backcountry Byway as special natural/interest areas • Existing management provisions would be retained for the HMA; management of the other redesignated special natural/interest areas would be affected by other 16 resource management elements. Additional management provisions could be implemented for the redesignated special natural/interest areas. The potential for altering existing or establishing additional special natural/interest areas would be evaluated.
• Key changes in existing management of special management areas and effects thereof include: ▪ allowing use of dead and downed wood in some portions of redesignated ACECs and within 150 feet of the former Backcountry Byway where this activity is currently prohibited, which could affect wildlife and wildlife habitat in these areas ▪ 32 percent reduction of road networks within redesignated ACEC special natural/interest areas, which would reduce impacts from vehicles and vehicle-associated activities and over time would rehabilitate larger unroaded areas	• Existing management of special management areas and effects thereof would continue, including: ▪ Existing prohibition on collecting dead and downed wood for campfire use in the ACECs and within 150 feet of the Backcountry Byway ▪ Retaining existing road network and low-level dispersed impacts associated with vehicle use of these roads and other connected activities such as vehicle-based camping within redesignated special natural/interest areas	• Potential decreased management of former special management areas, particularly with regard to road management, use of dead and downed wood, vehicle-based camping; potential increased management from other resource elements (e.g., resource monitoring, waste disposal rules and regulations, erosion control, etc.)	• Key changes in existing management of special management areas and effects thereof include: ▪ allowing use of dead and downed wood in some portions redesignated ACECs and within 150 feet of the former Backcountry Byway where this activity is currently prohibited, which could affect wildlife and wildlife habitat in these areas ▪ 32 percent reduction of road networks within redesignated ACEC special natural/interest areas, which would reduce impacts from vehicles and vehicle-associated activities and over time would rehabilitate larger unroaded areas	• Potential for the same or increased management provisions for special natural/interest areas, including: ▪ prohibiting use of dead and downed wood and native campfires within and outside of special management areas ▪ 42 percent reduction of road networks within redesignated ACEC special natural/interest areas, which would reduce impacts from vehicles and vehicle-associated activities and over time would rehabilitate larger unroaded areas

Outdoor Recreation				
Proposed Action	**Strategy A**	**Strategy B**	**Strategy C**	**Strategy D**
• Affects BMGR recreational opportunities as follows: ▪ Recreational driving: includes continued prohibition of off-road driving, reduction of the road network available to the public by 36 percent (mostly redundant roads in localized areas), prohibition of driving in washes unless they are part of the designated road system open to the public and are dry, and a special use permit for single parties with more than 10 vehicles (20 within Management Unit 2) required ▪ Camping: vehicle-based camping would continue to be allowed within 50 feet of public use roads with a 14-day consecutive stay limit, but this would be further limited by the closure of roads and localized restrictions along road segments and within ¼-mile of sensitive resources in addition to wildlife waters ▪ Wood gathering and firewood use: use of dead and downed wood for campfires allowed except for within Unit 1, new prohibition of native wood fires within Unit 1 (Tinajas Altas area) ▪ Rockhounding: limited to Management Units 2 and 3 (which includes BMGR-West area open to public access outside of Tinajas Altas area) and 25 pounds per person and restricted from redesignated ACECs; prohibited in Units 1, 4, 5, 6, and 7 (which includes Tinajas Altas area of BMGR-West and all of BMGR-East) ▪ Metal detectors: prohibited range-wide because of buried unexploded ordnance hazards ▪ Mine exploration: prohibited range-wide because of extreme safety hazards and bat roosting habitat ▪ Recreation shooting: not restricted except that a special use permit is required for shooting automatic weapons and at night ▪ Potential for additional effects based on the findings of assessments including a nominal fee for hunting on the BMGR, restrictions or limitations on non-game species collection, and establishment of designated camping and/or recreational shooting areas	• Affects BMGR recreational opportunities as follows: ▪ Recreational driving: includes continued prohibition of off-road driving, no reduction of the road network available to the public (totaling 968 miles), potential driving in some washes subject to the finalization of the Barry M. Goldwater East HMP, special use permit for single parties with more than 50 vehicles required ▪ Camping: no change from current conditions (vehicle-based camping must be within 50 feet of existing public use roads with a 14-day consecutive stay limit, no camping within ¼-mile of a wildlife water) ▪ Wood gathering and firewood use: collection of dead and downed wood would continue to be prohibited within ACECs and within 150 feet of Backcountry Byway ▪ Rockhounding: approved in all BMGR areas open to public access but limited to 24 pounds plus one piece per person ▪ Metal detectors: not restricted ▪ Mine exploration: all mines are off-limits to public entry ▪ Recreational shooting: may occur if compatible with military activities and public safety	• Affects BMGR recreational opportunities as follows: ▪ Recreational driving: includes continued prohibition of off-road driving, consideration of future designated off-road vehicle use area, no reduction of the road network available to the public (totaling 968 miles) potential establishment or opening of new roads for public use, public driving in designated washes, and a special use permit for single parties with more than 30 vehicles required ▪ Camping: would allow vehicle based camping within 100 feet of existing public use roads with a 14-day consecutive stay limit, but not within ¼-mile of a wildlife water ▪ Wood cutting and gathering and firewood use: no restrictions on any of these activities unless a regulatory compliance issue arises (except for prohibiting removal of wood from the range) ▪ Rockhounding: approved in all BMGR areas open to public access but limited to 24 pounds plus one piece per person ▪ Metal detectors: not restricted ▪ Mine exploration: all mines are off-limits to public entry ▪ Recreational shooting: may occur if compatible with military activities and public safety ▪ Potential for additional effects based on the findings of assessments including a nominal fee for hunting on the BMGR, restrictions or limitations on-game species collection, and establishment of designated recreational shooting and camping areas	• Affects on BMGR recreational opportunities as follows: ▪ Recreational driving: includes continued prohibition of off-road driving, reduction of the road network available to the public by 36 percent (mostly redundant roads in localized areas), prohibition of driving in washes unless they are part of the designated road system open to the public and are dry, and a special use permit for single parties with more than 20 vehicles required ▪ Camping: vehicle-based camping would continue to be allowed within 50 feet of public use roads with a 14-day consecutive stay limit, but this would be further limited by the closure of roads and localized restrictions along road segments and within ¼-mile of sensitive resources in addition to wildlife waters ▪ Wood gathering and firewood use: use of dead and downed wood for campfires allowed, all other forms of wood cutting or wood collection prohibited ▪ Rockhounding: limited to Management Units 2 and 3 (which includes BMGR-West area open to public access outside of Tinajas Altas area) and 25 pounds per person and restricted from redesignated ACECs; prohibited in Units 1, 4, 5, 6, and 7 (which includes Tinajas Altas area of BMGR-West and all of BMGR-East) ▪ Metal detectors: prohibited range-wide because of buried unexploded ordnance hazards ▪ Mine exploration: prohibited range-wide because of extreme safety hazards and bat roosting habitat ▪ Recreational shooting: not restricted except that a special use permit is required for shooting automatic weapons and at night ▪ Potential for additional effects based on the findings of assessments including a nominal fee for hunting on the BMGR, restrictions on non-game species collection, and establishment of designated camping areas	• Affects on BMGR recreational opportunities as follows: ▪ Recreational driving: includes continued prohibition of off-road driving, the reduction of the road network available to the public by 43 percent (mostly redundant roads in localized areas but also includes some cross regional routes), prohibition of driving in washes unless they are part of the designated road system open to the public and are dry, and special use permit for single parties with more than 10 vehicles required ▪ Camping: vehicle-based camping would continue to be allowed within 50-feet of public use roads with a 7-day consecutive stay limit, but this would be further limited by the closure of roads and localized restrictions along road segments and within ¼-mile of sensitive resources in addition to wildlife waters ▪ Wood gathering and firewood use: wood cutting and gathering prohibited, use of native wood for campfires prohibited ▪ Rockhounding, recreational shooting, use of metal detectors, and entry to mines all prohibited ▪ Potential for additional effects based on the findings of assessments including a nominal fee for hunting on the BMGR and establishment of designated camping areas. A request would be submitted to Arizona Game and Fish Commission to close BMGR to non-game species collection.
• Effects on BMGR recreational setting (i.e., appearance and character) would be mixed. Over time, road closures and enforcement of prohibitions on off-road driving would lead to a generally more natural and less intensively used appearing environment, but there may be increased evidence of other recreational users in some areas (e.g., along popular remaining open road corridors and at possible designated camping and recreational shooting areas and from land management/recreation use supervision)	• Little change to existing BMGR recreational setting would be expected, but some further and more widely distributed low-level deterioration of this setting would be likely over the long term in the absence of road closures or other use limitations. Implementation of the transportation plan could eventually lead to changes similar to the proposed action relative to road closures and reduced area for vehicle-based camping.	• Little change to existing BMGR recreational setting, less evidence of other recreational users and land management/recreation use supervision, additional seclusion for vehicle-based campers; ORV use areas were established, recreational setting would be affected within localized area	• Effects on BMGR recreational setting (i.e., appearance and character) would be mixed. Over time, road closures and enforcement of prohibitions on off-road driving would lead to a generally more natural and less intensively used appearing environment, but where there may be increased evidence of other recreational users in some areas (e.g., along popular remaining open road corridors, at possible designated camping and recreational shooting areas, and from land management/recreation use supervision)	• Effects on BMGR recreational setting would be mixed with the most dominant natural environmental conditions of all alternatives, but evidence of other recreational users (from road closures and reduced area for vehicle-based camping and possible designated camping and recreational shooting areas) and land management/recreation use supervision would be slightly greater than with the proposed action

Outdoor Recreation (continued)				
Proposed Action	**Strategy A**	**Strategy B**	**Strategy C**	**Strategy D**
• Road closures and other use limitations may deter some members of the public from visiting the BMGR but the long-term trend in recreation use of the range is expected to show a steady increase in visitation	• Long-term trend of increased recreation use would be expected although some members of the public looking for a natural setting less effected by roads and vehicle-based activities may be deterred from visiting	• There would be potential for decreases in BMGR recreation use patterns based on proposed assessments (e.g. a potential fee for hunting); however, if an ORV use area were established, recreation use might increase; the long-term trend would likely be for the increased use but possibly at the expense of visitors desiring a natural setting less dominated by roads and vehicle-based activities	• Effects on BMGR recreation use would be mixed, with a greater potential for decreased use than increased use, but overall trend of increased visitation would be predominant	• Effects on BMGR recreation use would be mixed, with the greatest potential for decreased use of all the alternatives, but overall trend of increased visitation would be predominant
• Would result in a fundamental change to a limits of acceptable change approach to recreational management, which would directly link recreation management decision-making with resource conservation, rehabilitation, and protection of objectives. If the findings of the inventory and monitoring reveal that deleterious effects are occurring as a result of recreation use, adaptive management responses could modify, limit, or restrict recreational access or activities to address identified resource conservation and protection problem. Potential negative or limiting effects on public access/recreation may be offset by enhanced visitor education or law enforcement to reduce potential for exceeding limits of acceptable change thresholds	• No management tools providing effects-based linkages between decision-making for resource conservation, rehabilitation, or protection and regulation of public access and recreation activities would be established; rather, recreation management would remain on a reactionary, regulatory compliance-based footing • Some types of recreation management would continue to be somewhat defined by the redesignated ACECs, SRMAs, and Backcountry Byway rather than by the INRMP management units; there would be no additional or revised rules or prohibitions to implement nor a minimum required number of law enforcement officers	• For the most part, recreation management would occur based on current programs without a change to a limits of acceptable change and adaptive management approach; no special management provisions would be continued for the expired ACECs, SRMAs, and Backcountry Byway and no other special natural/interest areas would be established other than the flat-tailed horned lizard HMA, so nearly all recreation management would be based on either a range-wide or a unit-by-unit basis; a minimum of two law enforcement officers would be required	• Would result in a fundamental change to a limits of acceptable change approach to recreational management, which would directly link recreation management decision-making with resource conservation, rehabilitation, and protection of objectives. If the findings of the inventory and monitoring reveal that deleterious effects are occurring as a result of recreation use, adaptive management responses could modify, limit, or restrict recreational access or activities to address identified resource conservation and protection problem. Potential negative or limiting effects on public access/recreation may be offset by enhanced visitor education or law enforcement to reduce potential for exceeding limits of acceptable change thresholds	• Would result in a fundamental change to a limits of acceptable change approach to recreational management, which would directly link recreation management decision-making with resource conservation, rehabilitation, and protection of objectives. If the findings of the inventory and monitoring reveal that deleterious effects are occurring as a result of recreation use, adaptive management responses could modify, limit, or restrict recreational access or activities to address identified resource conservation and protection problem. Potential negative or limiting effects on public access/recreation may be offset by enhanced visitor education or law enforcement to reduce potential for exceeding limits of acceptable change thresholds
• Other minor proposed changes to recreation management would include use of INRMP management units and objectives related to record keeping system, minimum number of law enforcement officers, gates and fencing, and coordinating with adjacent land managers. Based on new or revised rules or prohibitions, there would be an increased recreation management workload			• Other minor proposed changes to recreation management would include use of INRMP management units and objectives related to record keeping system, minimum number of law enforcement officers, gates and fencing, and coordinating with adjacent land managers. Based on new or revised rules or prohibitions, there would be an increased recreation management workload	• Other minor proposed changes to recreation management would include use of INRMP management units and objectives related to record keeping system, minimum number of law enforcement officers, gates and fencing, and coordinating with adjacent land managers. Based on new or revised rules or prohibitions, there would be an increased recreation management workload
• Minor effects on recreation outside of the BMGR may occur if recreational users visit non-BMGR locations for outdoor recreation opportunities that would no longer be available or more strictly controlled on the BGMR, plus any impacts to recreationalists from agency use of roads within the northwest Cabeza Prieta NWR Wilderness would be eliminated (if refuge bypass roads were established)	• No change in recreation use in the vicinity of the BMGR as a result of management changes within the range would be expected, at least in the short term; future management planning including future transportation planning could divert recreational use from the BMGR to off-range locations	• No change in recreation use in the vicinity of the BMGR as a result of use limitations within the range would be expected, at least in the short term; however, minor decreased uses of off-range lands may occur if new on-range opportunities are established (an ORV use area, entry to mine[s]) and increases may occur if there are new restrictions (e.g., fee for hunting); would have the same effects as the proposed action with the refuge bypass roads	• Minor effects on recreation outside of the BMGR may occur if recreational users visit non-BMGR locations for outdoor recreation opportunities that would no longer be available or more strictly controlled on the BGMR, plus any impacts to recreationists from agency use of roads within the northwest Cabeza Prieta NWR Wilderness would be eliminated (if refuge bypass roads were established)	• More minor effects on recreation outside of the BMGR may occur as compared to the proposed action if recreational users visit non-BMGR locations for outdoor recreation opportunities that would no longer be available or more strictly controlled on the BGMR, plus any impacts to recreationists from agency use of roads within northwest Cabeza Prieta NWR Wilderness would continue (as no refuge bypass roads would be established)
Public Health and Safety				
Proposed Action	**Strategy A**	**Strategy B**	**Strategy C**	**Strategy D**
• New rules of conduct would slightly reduce the risks associated with visitor activities. These include implementing sewage and waste disposal rules, prohibiting wood cutting, prohibiting metal detectors; all safety requirements associated with military activities would continue to be implemented	• No additional public health and safety objectives would be implemented; all safety requirements associated with military activities would continue to be implemented	• New sewage and waste disposal rules would be implemented; all safety requirements associated with military activities would continue to be implemented. Potential for new risks if public entry to mines is allowed or designated ORV use areas are established.	• New rules of conduct would slightly reduce the risks associated with visitor activities. These include implementing sewage and waste disposal rules, prohibiting wood cutting, prohibiting metal detectors; all safety requirements associated with military activities would continue to be implemented	• New rules of conduct would reduce the risks associated with visitor activities. These include implementing sewage and waste disposal rules, prohibiting wood cutting, prohibiting metal detectors, and prohibiting recreational shooting; all safety requirements associated with military activities would continue to be implemented
Law Enforcement				
Proposed Action	**Strategy A**	**Strategy B**	**Strategy C**	**Strategy D**
• Closure of approximately 36 percent of public access road mileage would increase law enforcement workload in the short term (to keep visitors off of closed roads), but would decrease the miles of road to patrol	• Retention of existing road network would result in same number of miles of road to patrol, but would not increase workload associated with enforcing road closures	• Retention of existing road network and potential addition of new roads could increase the number of miles of road to patrol, but would not increase workload associated with enforcing road closures	• Closure of approximately 36 percent of public access road mileage would increase law enforcement work load in the short term (to keep visitors off of closed roads), but would decrease the miles of road to patrol	• Closure of approximately 43% of public access road mileage would increase law enforcement workload in the short term (to keep visitors off closed roads), but would decrease the miles of road to patrol in the long term after roads revegetate

Law Enforcement (continued)				
Proposed Action	**Strategy A**	**Strategy B**	**Strategy C**	**Strategy D**
• Management provisions for the following resource management elements could create additional law enforcement requirements on the range: ▪ motorized access and unroaded area management ▪ wood collection and firewood use restrictions (in Unit 1) ▪ recreational shooting limitations ▪ single-party vehicle limits	• Law enforcement requirements would not increase relative to existing conditions	• Management provisions for the following resource management elements could create additional law enforcement responsibilities on the range, although not to the degree of the proposed action: ▪ camping and visitor stay limits	• Management provisions for the following resource management elements could create additional law enforcement requirements on the range: ▪ motorized access and unroaded area management ▪ recreational shooting limitations ▪ single-party vehicle limits ▪ rockhounding limitations	• Management provisions for the following resource management elements could create the greatest amount of law enforcement requirements on the range: ▪ motorized access and unroaded area management ▪ 7-day camping and visitor stay limits ▪ rockhounding prohibition ▪ wood collection and native firewood use ▪ recreational shooting prohibition ▪ soil and water resources
• Increased responsibilities would be alleviated by the retention of a minimum of six full-time law enforcement positions on the range	• No minimum number of law enforcement positions required	• Although additional burden would be placed on DoD law enforcement, there would be a minimum of two full-time law enforcement positions	• Increased responsibilities would be alleviated by the retention of a minimum of four full-time law enforcement positions on the range	• Increased responsibilities would be alleviated by the retention of a minimum of six full-time law enforcement positions on the range
Transboundary and Domestic Perimeter Land Use				
Proposed Action	**Strategy A**	**Strategy B**	**Strategy C**	**Strategy D**
• Changes in management could potentially result in a minor shift in recreation use away from the BMGR to adjacent lands because of new limitations on recreational opportunities	• No change in visitation patterns to the BMGR or other locations within the BMGR region are anticipated as a result of new creation use limitations within the BMGR	• Potential new recreation opportunities could potentially attract a minor amount of recreational use to the BMGR and away from adjacent lands (change would be expected to be small)	• Changes in management could potentially cause a minor shift in recreation use away from the BMGR to adjacent lands because of new limitations on recreational opportunities	• Changes in management could potentially cause a minor shift in recreation use away from the BMGR to adjacent lands because of new limitations on recreational opportunities
• Land management decisions based on shared data and increased coordination between BMGR land managers and adjacent land managers would occur under objectives for: ▪ resource inventory and monitoring ▪ wildlife water development research ▪ surveys for special status species ▪ soil surveys ▪ perimeter land management coordination and regional planning	• No increased emphasis in coordination or information sharing between the BMGR and adjacent land managers would be promoted	• Although it would occur to a lesser degree than the proposed action, land management decisions based on shared data between BMGR land managers and adjacent land managers would occur under management objectives for: ▪ surveys for special status species ▪ perimeter land manager coordination and regional planning	• Land management decisions based on shared data and increased coordination between BMGR land managers and adjacent land managers would occur under objectives for: ▪ resource inventory and monitoring ▪ wildlife water development research ▪ surveys for special status species ▪ perimeter land manager coordination and regional planning	• Land management decisions based on shared data and increased coordination between BMGR land managers and adjacent land managers would occur under objectives for: ▪ resource inventory and monitoring ▪ wildlife water development research ▪ surveys for special status species ▪ soil surveys ▪ perimeter land manager coordination and regional planning
Cultural Resources				
Proposed Action	**Strategy A**	**Strategy B**	**Strategy C**	**Strategy D**
• Resource survey and monitoring in support of ICRMP objectives would emphasize increased focus on identifying sources and extent of actual and potential impacts as a result of public access and government activities	• Resource surveys and compliance monitoring and survey, in accordance with the ICRMP, would identify some sources of impacts on cultural resources resulting from public access and government activities but less effectively than the proposed action	• Resource survey and compliance monitoring would function as for Strategy A but additional emphasis on compliance may improve cultural resources protection effects	• Resource survey and monitoring in support of ICRMP objectives would emphasize increased focus on identifying sources and extent of actual and potential impacts as a result of public access and government activities	• Resource survey and monitoring in support of ICRMP objectives would emphasize increased focus on identifying sources and extent of actual and potential impacts as a result of public access and government activities
• Redesignation of the expired Tinajas Altas Mountains ACEC as a special natural/interest area would promote continuing protection of sensitive cultural resources	• Redesignating ACECs, SRMA, HMA, and Backcountry Byway as special natural/interest areas and continuing the management provisions for these special management areas would continue to provide some protection of cultural resources within these locations	• Not redesignating special management areas as special natural/interest areas could potentially reduce protection of cultural resources	• Redesignation of the expired Tinajas Altas Mountains ACEC as a special natural/interest area would promote continuing protection of sensitive cultural resources	• Redesignation of the expired Tinaja Altas Mountains ACEC as a special natural/interest area would promote continuing protection of sensitive cultural resources
• Reducing the road network would likely reduce intentional and unintentional impacts on cultural resources in areas where roads are closed	• Retaining the current road network would likely result in more unintentional and intentional greater cultural resource impacts as compared to the reduced road network under the proposed action	• Potential increase in road network beyond current conditions could increase impacts to cultural resources in areas that were previously inaccessible by vehicles • Establishing public off-road driving areas would likely conflict with ICRMP goal to preserve cultural resources in place to the extent compatible with military missions	• Reducing the road network would likely reduce intentional and unintentional impacts on cultural resources in areas where roads are closed	• Reducing the road network would likely reduce intentional and unintentional impacts on cultural resources in areas where roads are closed

Cultural Resources (continued)				
Proposed Action	**Strategy A**	**Strategy B**	**Strategy C**	**Strategy D**
• Provisions to close selected road segments (if effective alternative protective measures are not available) to protect sensitive cultural resources, restrict camping within ¼ mile of designated sensitive cultural resources, conserve unroaded areas, reduce single-party vehicle limit to 19 (vs. the current limit of 49) without a special use permit, prohibit the use of metal detectors, prohibit recreational shooting with automatic weapons without a special use permit, restrict rockhounding in Units 2 and 3 from special natural/interest areas or other designated locations, and prohibit rockhounding in Units 1, 4, 5, 6, and 7, would reduce the potential for intentional and unintentional impacts on cultural resources • Increasing the emphasis on educating visitors about cultural resource values, sensitivities, and legal protections and increasing the law enforcement presence on the range would reduce the risks of both unintentional and intentional damage/theft of these resources	• Continuing the existing limits and restrictions on recreation activities would leave the potential unintentional and intentional impacts on cultural resources unchanged compared to existing conditions	• Impacts could increase by extending the allowance for vehicle-based camping along road margins to 100 feet	• Provision to restrict camping within ¼-mile of designated sensitive cultural resources could reduce potential for adverse impacts and intentional vandalism • Increasing the emphasis on educating visitors about cultural resource values, sensitivities, and legal protections and increasing the law enforcement presence on the range would reduce the risks of both unintentional and intentional damage/theft of these resources • Provisions to regulate or prohibit recreational activities would have the same potential to protect cultural resources as the proposed action except that rockhounding would be allowed range-wide and restricted only from special natural/interest areas or other specially designated locations which would slightly increase the potential for cultural resource damage from this activity compared to the proposed action	• Provision to restrict camping within ¼-mile of designated sensitive cultural resources could reduce potential for adverse impacts and intentional vandalism • Increasing the emphasis on educating visitors about cultural resource values, sensitivities, and legal protections and increasing the law enforcement presence on the range would reduce the risks of both unintentional and intentional damage/theft of these resources • Provisions to regulate or prohibit recreational activities would have the same potential to protect cultural resources as the proposed action except that rockhounding and recreational shooting would be prohibited everywhere on the range, which would eliminate potential cultural resource damage from these activities, and the single-party vehicle limit would be further reduced to 9 and the visitor stay limit per 28 day period would be reduced to 7 consecutive days, which would also slightly further reduce the potential of cultural resources damage from recreational activities
Visual Resources				
Proposed Action	**Strategy A**	**Strategy B**	**Strategy C**	**Strategy D**
• Road closures and recreation use management would result in a shift in the visual setting over time from a more semi-primitive setting towards a more primitive condition, where there are larger unmodified appearing areas; plus, active restoration in areas that have been damaged by a discontinued military, agency, or intensive public use could eliminate some visual scars	• Existing road network and semi-primitive setting would be retained, does not include objectives for restoration of closed roads or discontinued use areas	• Due to potential creation of new roads and increased public access and use opportunities, manmade modification would be more predominant than under the current conditions; although restoration in areas that have been damaged by a discontinued military, agency, or intensive public use could eliminate some visual scars	• Road closures and recreation use management would result in a shift in the visual setting over time from a more semi-primitive setting towards a more primitive condition, where there are larger areas that are unmodified appearing areas, plus, active restoration in areas that have been damaged by a discontinued military, agency, or intensive public use could eliminate some visual scars	• More road closures and resource protection than the proposed action, plus active restoration of closed roads (where feasible) and in areas that have been damaged by a discontinued military, agency, or intensive public use could eliminate some visual scars
• Developing up to six new wildlife waters during first five years of the INRMP (could be more depending on the results of studies) would create new minor manmade modifications to the near- to middle-ground landscape, however, waters can now be developed that are unobtrusive unless a new access road is required	• Developing up to 17 new wildlife waters would create new minor manmade modifications to the landscape (up to six would be implemented during the first five years of the INRMP); site-specific impacts would be dependent on the location and type of development	• Developing up to 17 or more new wildlife waters would create new minor manmade modifications to the landscape (up to six would be implemented during the first five years of the INRMP); site-specific impacts would be dependent on the location and type of development	• Developing up to six new wildlife waters in first five years of the INRMP (could be more depending on the results of studies) would create new minor manmade modifications to the near- to middle-ground landscape, however, waters can now be developed that are unobtrusive unless a new access road is required	• Suspending wildlife water developments during the first five years of the plan (and potentially longer) would eliminate this minor source of visual modification (at least in the first five years of the INRMP)
• Potential to concentrate recreation use areas (such as designated camping areas) could detract from the natural conditions in local areas, but would be offset by a change in viewer expectations	• Recreation use would remain dispersed and therefore there would be no change in the visual setting	• Recreation use would remain dispersed and therefore there would be no change in the visual setting	• Potential to concentrate recreation use areas (such as designated camping areas) could detract from the natural conditions in local areas, but could be offset somewhat by a change in viewer expectations	• Potential to concentrate recreation use areas (such as designated camping areas) could detract from the natural conditions in local areas to a slightly greater extent than the proposed action, but could be offset somewhat by a change in viewer expectations
• Potential development of Yuma Area Service Highway would be a new modification in the westernmost portion of the BMGR and create new viewpoints within the BMGR	• Any future utility/transportation corridors projects would create manmade modifications	• Potential development of Yuma Area Service Highway would be a new modification in the westernmost portion of the BMGR and create new viewpoints within the BMGR; additional corridor projects could have similar visual effects	• Potential development of Yuma Area Service Highway would be a new modification in the westernmost portion of the BMGR and create new viewpoints within the BMGR	• Yuma Area Service Highway and all other future corridor projects would be prohibited, which would preclude related impacts to visual resources
• Continues existing visual resource management objectives; site-specific projects would be assessed for visual resource impacts through regulatory compliance process and needed management or mitigation actions would be implemented	• Continued visual resource management policies would extend existing visual resource effects, does not include an objective to assess the visual effects of new actions	• Continues existing visual resource management objectives; site-specific projects would be assessed for visual resource impacts through regulatory compliance process, and needed management or mitigation actions would be implemented	• Visual resource management objectives include those of the proposed action, plus the visual effects of new actions would be assessed using BLM's visual resource management objectives	• Provide a greater extent of BMGR visual resources management objectives than the proposed action; effects of new actions would be assessed using BLM's visual resource management objectives and additional measures for visual resource management in unroaded areas are included

Hazardous Materials and Waste				
Proposed Action	**Strategy A**	**Strategy B**	**Strategy C**	**Strategy D**
• Decreases the potential area in which a release of hazardous materials or wastes transported by vehicles might occur by reducing the road network by about 30 percent; potential designated recreational shooting and camping areas, if established, would introduce areas of concentrated sources of human sewage, trash, vehicle fluids, and lead bullets	• No change in potential areas in which a release of hazardous materials or wastes release might occur,	• Increases the potential area in which a release of hazardous materials or wastes might occur by retaining the existing road network and providing opportunities to expand the road network	• Decreases the potential area in which a release of hazardous materials or wastes transported by vehicles might occur by reducing the road network by about 30 percent; potential designated recreational shooting and camping areas. if established, would introduce areas of concentrated sources of human sewage, trash, vehicle fluids, and lead bullets	• Decreases the potential area in wh ich a release of hazardous materials or wastes transported by vehicle might occur by reducing the road network by about 34 percent; potential designated camping areas, if established, would introduce areas of concentrated sources of human sewage, trash, and vehicle fluids, prohibiting recreational shooting would eliminate the need for designated shooting areas and associated hazardous materials and waste issues.
• Limiting visitor stays to 14 days and limiting party sizes to 9 (Units 1, 3, 6, 7) or 19 (Unit 2) vehicles (except by special use permit) for the majority of the range, could minimize the potential for hazardous materials or waste dumping on the BMGR • Increased emphasis on visitor education and law enforcement patrols would increase deterrence of unintentional and intentional disposal of hazardous materials or wastes	• Allowing large party sizes (up to 49 vehicles) without a special use permit and lack of a minimum number of law enforcement positions reduces potential to minimize illegal disposal compared to the proposed action	• Increasing recreational opportunities on the BMGR (which could attract larger numbers of visitors), allowing larger party sizes (up to 29 vehicles without a special use permit) than proposed action, and retaining a minimum to two law enforcement positions to patrol a large area reduces the potential to prevent hazardous material and waste disposal compared to the proposed action	• Limiting visitor stays to 14 days, limiting party sizes to 19 vehicles (except by special use permit) could minimize quantity of waste on BMGR, but not as effectively as proposed action • Increased emphasis on visitor education and law enforcement patrols would increase deterrence of unintentional and intentional disposal of hazardous materials or wastes	• Limiting visitor stays to 7 days, limiting party sizes to nine vehicles (except by special use permit) could minimize quantity of waste on BMGR; effect would be similar to, but slightly better than, the proposed action • Increased emphasis on visitor education and law enforcement patrols would increase deterrence of unintentional and intentional disposal of hazardous materials or wastes
Socioeconomic Resources				
Proposed Action	**Strategy A**	**Strategy B**	**Strategy C**	**Strategy D**
• Increases work and/or expenditures within the socioeconomic study area with implementation of additional inventory, monitoring, surveying, and studies; retaining at least six law enforcement officers; expanding public education programs; and implementing program objectives	• Does not introduce new activities that would generate additional work and/or result in expenditures	• Slightly increases work and/or expenditures, but fewer work opportunities than with proposed action	• Increases work and/or expenditures within the socioeconomic study area with implementation of additional inventory, monitoring, surveying, and studies; retaining at least four law enforcement officers; expanding public education programs; and implementing program objectives; somewhat less work generated than the proposed action	• Increases work and/or expenditures within the socioeconomic study area with implementation of additional inventory, monitoring, surveying, and studies; retaining at least six law enforcement officers; expanding public education programs; and implementing program objectives; somewhat more work generated than the proposed action
• Potentially decreases range visitation and recreation use by reducing the existing road network and recreational opportunities; could reduce visitor purchase of goods, services, and sundries from nearby communities (although amounts would likely be negligible and overall increase in visitation would be predominant in the long term)	• Would not promote change in existing visitation patterns so visitor purchases in nearby communities would remain unchanged by this alternative	• Potentially increases range visitation and recreation use because of increased recreational opportunities; could potentially increase visitor purchases in nearby communities (although amounts would likely be negligible and overall increase in visitation would be predominant in the long-term)	• Potentially decreases range visitation and recreation use by reducing the existing road network and recreational opportunities; could reduce visitor purchase of goods, services, and sundries from nearby communities (although amounts would likely be negligible and overall increase in visitation would be predominant in the long-term)	• Potentially decreases range visitation and recreation use by reducing the existing road network and recreational opportunities; could reduce visitor purchase of goods, services, and sundries from nearby communities (while amounts would likely be negligible, the decreases could be greater than with the proposed action, but an overall increase in visitation would be predominant in the long-term)
• Complements those public attitudes and values that favor a balance of public access and use opportunities and resource protection and conservation	• Public concerns about the shortcomings of management under the Goldwater Amendment would likely remain	• Supports the contingent whose attitudes and values favor public access and use opportunities	• Complements those public attitudes and values that favor a balance of public access and use opportunities and resource protection and conservation	• Supports the contingent whose attitudes and values favor resource protection and conservation
• Allows for Yuma Area Service Highway, which would support the local economy; prohibits any other future utility/transportation corridors, which could hinder utility company developments	• Would likely allow for Yuma Area Service Highway, which would support the local economy; restricts utilities to existing corridors, which could negatively hinder other potential utility developments in the region	• Allows for Yuma Area Service Highway and allows for consideration of additional utility/transportation corridors if compatible with the military mission, which would support the local economy and potentially other public utility/highway developments in the region	• Allows for Yuma Area Service Highway, which would be positive for the local economy; prohibits any other future utility/transportation corridors, which could negatively hinder other potential utility developments in the region	• Prohibits Yuma Area Service Highway, delaying project schedule and impacting the local economy; prohibits any other future in the utility/transportation corridors, which could hinder potential utility/transportation developments in the region

Noise				
Proposed Action	**Strategy A**	**Strategy B**	**Strategy C**	**Strategy D**
• Potentially decreases average environmental noise in localized settings by minor amounts, compared to existing conditions, as a result of reducing size of road network, limiting single parties to 9 (in Units 1, 3, 6, 7) or 19 (Unit 2) vehicles, without a special use permit, and restricting recreational shooting to daylight hours and prohibiting any use of automatic weapons without a special use permit	• No reduction in road network, single-party sizes of up to 49 vehicles without a special use permit, and no restrictions on recreational shooting at night or with automatic weapons would leave existing environmental noise conditions unchanged	• Potential expansion of road network and designation of public off-road vehicle areas could result in local increases in environmental noise conditions compared to the existing conditions	• Same environmental noise effects as proposed action except the single-party limit on vehicles, without a special use permit, would be 19 in all units which would have only a slight potential to increase noise above the proposed action level	• Includes about the same localized reduction in noise impacts range-wide as the proposed action; however, compared to the proposed action, decreases noise by also foreclosing the possibilities for Yuma Area Service Highway and all recreational shooting
Environmental Justice				
Proposed Action	**Strategy A**	**Strategy B**	**Strategy C**	**Strategy D**
• No environmental justice effect	• No environmental justice effect	• No environmental justice effect	• No environmental justice effect	• No environmental justice effect

CHAPTER 4 AFFECTED ENVIRONMENT

4.1 INTRODUCTION

The existing conditions of BMGR natural and cultural resources and the existing status of various resource management activities that may be affected by the implementation of the proposed or alternative INRMP management strategies are described in this chapter. The conditions of the following 20 resource and management activity categories are described. The foreseeable environmental effects of the proposed and alternative management strategies on these same resource and management activity categories are described in Chapter 5.

- earth resources
- water resources
- climate and air resources
- vegetation
- wildlife and wildlife habitat
- protected species
- wildfire management
- grounds maintenance
- public utility and transportation corridors
- special natural/interest areas
- outdoor recreation
- public health and safety
- law enforcement
- transboundary and domestic perimeter land use
- cultural resources
- visual resources
- hazardous materials and waste
- socioeconomics
- noise
- environmental justice

The descriptions of these 20 resource and management activity categories are based on available data including published and unpublished literature, agency consultations, and public and tribal input. For most categories, the affected environment is primarily limited to the lands within the BMGR. For others, the affected environment includes adjacent lands and airspace associated with aircrew training on the BMGR.

The description of each resource or management activity has been subdivided into four sections. First, the existing conditions are defined, including any applicable assessment of the range-wide, regional, state, or national value of each resource or management activity. Where applicable, a description of the ecoregional/regional context is addressed.

Next, the relationship between the resource or management activity and the military mission is assessed. This assessment describes the extent to which the resource or management activity currently supports or sustains the military mission, whether it directly or indirectly affects the conduct of the mission, and the degree to which the resource is consumed or otherwise affected by the military mission.

The third subsection provides a description of the current management plans, management actions, and regulatory and statutory requirements that are applicable to the resource or management activity. This subsection may include a general description of the agencies with direct or indirect management responsibilities; existing resource management plans (e.g., habitat management plans), annual resource surveys, studies, or projects; and/or existing statutory and regulatory compliance actions dictated by decisions or agreements (e.g., biological opinions, recovery plans, or court decisions). Some of these management plans may have been prepared under FLPMA, which no longer applies to the BMGR[30]. However, the plans and management actions that occurred under these plans are part of the existing condition.

The fourth subsection describes existing data or information that is not currently available but would support better future management of the natural and cultural resources within the BMGR. The described information (such as the findings of a comprehensive soil survey or certain visitor use data) would facilitate the ultimate effectiveness of range resource management. The fact that these management data or information needs are identified in Chapter 4 should not be construed to indicate that a gap exists that would affect the evaluation of reasonably foreseeable effects of the proposed and alternative INRMP management strategies on the human environment in Chapter 5. The CEQ regulations implementing NEPA specifically define how incomplete or unavailable information, which is relevant to determining reasonably foreseeable significant adverse effects on the human environment, is to be addressed in an EIS [40 CFR §1502.22]. Incomplete or unavailable information needed to determine reasonably foreseeable significant adverse effects is identified in Chapter 5, Environmental Consequences, in accordance with 40 CFR § 1502.22.

4.2 EARTH RESOURCES

This section defines the character and condition of the physical BMGR landscape and the geologic processes that have shaped and continue to modify its form and functions. Earth

[30] The MLWA of 1986, P.L. 99-606 §3(a)(1), provided that the BMGR would be managed by the Secretary of the Interior "pursuant to the Federal Land Management Policy Act of 1976 (43 U.S.C. 1701 et seq.)." The MLWA of 1999, P.L. 106-65 §3031(b)(1)(a) and (b)(3)(D), provide that the range will be managed by the Secretaries of the Navy and the Air Force in accordance with an INRMP prepared and implemented in accordance with the Sikes Act.

resources are generally regarded as including the consolidated and unconsolidated rock material that makes up the Earth's outer mantle as well as the soils that have developed from this material. From an ecological perspective, earth resources provide the substrate upon and within which biological and cultural systems draw physical support, nutrient sustenance, water, and shelter. The shape of the physical landscape influences both macro and micro climatic conditions and can serve either as a conveyance or barrier to biological movement and migration. Humans further exploit earth resources to extract sources of energy, precious metals and gemstones, construction and manufacturing materials, and chemicals.

Economic development of earth resources within the BMGR has been excluded by land withdrawals since World War II and will continue to be excluded under the MLWA of 1999 until at least late 2024. Nevertheless, shafts, excavations, tailings, rock works, and roads appear on the range as a result of mining activity prior to 1941. These features have become part of the physical landscape that affects and influences biological species and processes as well as human activities.

Recognition of the critical, fundamental roles that earth resources play in sustaining healthy productive ecosystems and furthering human activities is essential if the range is to be managed successfully for long-term support of continuing and future military missions, in accordance with ecosystem management principals, to protect sensitive natural and cultural resources, and to provide sustainable public recreation opportunities. This section provides the background information needed to incorporate earth resources management and to assess the consequences of the resource management alternatives under consideration in this EIS.

4.2.1 Existing Conditions

The physical landscape of the Sonoran Desert has been shaped by tectonic (or mountain building) processes of uplift, faulting, folding, and volcanism and the counter actions of weathering, erosion, and alluvial deposition. The characteristic appearance of this landscape, with relatively low but sharp and angular mountain ranges separated by broad flat valleys, reflects both its tectonic origins and the fact that it has been reshaped predominantly by the erosional and depositional processes of arid climatic regimes.

Although sometimes portrayed as an unchanging, timeless landscape, the Sonoran Desert formed quite recently as a physical landscape in terms of geologic time. In fact, along with the other three North American deserts, it is among the youngest landscapes on the continent. Although 98 percent of the Earth's history occurred during the first three of its four geologic eras, the Cenozoic (the fourth and most recent) is the most tangible era in terms of the modern appearance of the BMGR landscape. The Cenozoic era is comprised of the Tertiary and Quaternary periods, each of which is further subdivided into shorter geologic epochs. Table 4-1 shows the major geological events that formed the Sonoran Desert in context of these geologic time scales.

In general, two types of mountain landforms—the block-faulted, sharp-crested mountains and bedded mesa-type basaltic mountains—visible today within the BMGR were produced during the late Tertiary and Quaternary periods. Although the processes that created these features—tectonic faulting, folding, and volcanism—are now inactive, erosion and deposition continue to actively shape the BMGR landscape creating the ten topographic features that complete the characteristic appearance of the region. These features include mountain ranges, volcanic

TABLE 4-1
GEOLOGICAL HISTORY OF THE SONORAN DESERT

	Principal Events
Cenozoic Era	
• ***Quaternary Period*** Holocene Epoch 0-11,000 years ago	Basaltic (black lava) eruptions in Pinacate Volcanic Field (in the southern Cabeza Prieta NWR and northern Sonora, Mexico) continued. The most recent expansion of the Sonoran Desert into its modern area in Arizona and California occurred 9,000 years ago, with the modern communities of plants and animals developing 4,500 years ago. (Note: The beginning of the Holocene was historically defined as the end of the Pleistocene Ice Age. Today we understand that there were 15 to 20 glacial periods during the Pleistocene and that the Holocene is the present interglacial period of cyclic environmental fluctuation.)
• ***Quaternary Period*** Pleistocene Epoch 11,000 to about 1.8 million years ago	Mountain glaciers covered the tops of the Rocky Mountains, Sierra Nevada, and Sierra Madre del Sur (in south-central Mexico). Basaltic eruptions in the Pinacate Volcanic Field occurred. Ponds and lakes were common in southern Arizona. Pine-oak woodlands were widespread in the present Arizona Upland subdivision of the Sonoran Desert (middle-elevation plant communities where saguaros are now).
• ***Tertiary Period*** Pliocene Epoch 1.8 to 5.3 million years ago	The Sonoran Desert was broken into north-south trending basins and mountain ranges (such as the Growler Valley, generally bound by the Growler and Granite mountains). Sediments eroded from the ranges and filled the basins. Baja California began to separate from Mexico and the Sea of Cortez was formed.
• ***Tertiary Period*** Miocene Epoch 5.3 to 23 million years ago	Silicic (derived from dioxides of silicon) volcanic eruptions occurred in the Chiricahua Mountains in eastern Arizona and the Sierra Madre del Sur in Mexico. Metamorphism (change in rock composition as a result of pressure and heat) formed metamorphic core complexes in many large mountain ranges in southern Arizona. Folding and faulting of the earth's crust continued, resulting in the formation of many mountain ranges in the Sonoran Desert, including most of the mountain ranges on the BMGR. Volcanic calderas (broad, craterlike basins) are formed in some mountains, including the Crater Range. The Sonoran Desert physical environment was formed during a drying trend about 8 million years ago.
• ***Tertiary Period*** Oligocene Epoch 23.7 to 36.6 million years ago	Violent volcanic eruptions occurred, creating the major modern physiographic provinces of North America. The Sierra Madre Occidental (in Mexico) was formed about 30 million years ago, defining the southeastern edge of the Sonoran Desert.

TABLE 4-1
GEOLOGICAL HISTORY OF THE SONORAN DESERT

	Principal Events
• ***Early Tertiary Period*** Eocene and Paleocene Epochs 36.6 to 66.4 million years ago	Soon after the extinction of the dinosaurs (65 million years ago), most of North America was covered with temperate evergreen and tropical rainforests. A land bridge extension still linked North America and Europe. Silicic volcanism, severe compression, and granite and porphyry (large, distinct crystals embedded in a fine-grained matrix) copper emplacement occurs in the core of many Sonoran Desert mountains.
Mesozoic Era 66.4 to 245 million years ago	Volcanism and erosion occurred in what is now southeast Arizona. The Gulf of Mexico extended into the region. The last of Arizona's inland seas came and went, leaving thick reef deposits in southeastern Arizona near Bisbee. Uplift of the Rocky Mountains occurred, having a profound effect on the future Sonoran Desert as volcanoes erupted and large masses of granite intruded to form the core of many mountain ranges, including the Mohawk Mountains. The backbone rock of the Sierra Nevada and Sierra San Pedro Martir (in Baja California) were formed, creating considerable high country west of the present day Sonoran Desert.
Paleozoic Era 245 to 570 million years ago	Many shallow seas encroached over the region, then retreated leaving thick sediment deposits, mostly limestone made of the remains of invertebrates. The future central Arizona region remained above sea level. What is now northern Arizona alternately became a delta, dune desert, and shallow sea.
Precambrian Era 570 million to 4.5 billion years ago	The Sonoran Desert land region was unformed and mostly under the sea. About 1.6 billion years ago, a huge mountain range formed. Sediments were transformed into metamorphic rocks and intruded by granite. Eventually, these mountains were eroded back down to sea level.
Source: Adapted from Phillips and Comus 2000 and U.S. Air Force 1986	

landforms, pediments, alluvial fans and bajadas, valleys, washes, playas, dunes, river terraces, and caves (Phillips and Comus 2000; U.S. Air Force1986). A brief description of each of these features is provided in Table 4-2 and Figure 4-1 exhibits general BMGR geological features.

4.2.1.1 Physiography

The BMGR is located within the Basin and Range Physiographic Province of the western United States (Fenneman 1931). This province is characterized by steep, rocky, discontinuous subparallel mountain ranges that trend northwest to southeast and are separated by broad, gently sloping to nearly flat, deep, alluvial valleys or basins. The Basin and Range Physiographic Province can be broken into two sections that display unique landscape characteristics—the Sonoran Desert and Salton Trough. Most of the BMGR is in the Sonoran Desert section; however, the Yuma Desert, in the southwestern BMGR, is within the Salton Trough section. The BMGR region is generally distinguished from the rest of the Basin and Range Physiographic Province by its lower, narrower, and more rugged mountains (U.S. Air Force 1986).

Another important element in understanding the physiography of an area is the relative occurrence of modern earthquake activity. Seismic source zones are regions with distinct seismogenic or earthquake generating character. The BMGR is located in the Southern Basin and

Range seismic source zone, which extends from Mexico into southern California and includes most of southwestern and central Arizona. The maximum earthquake magnitude that has been estimated for this seismic source zone is 6.0 on the Richter Scale (Bausch and Brumbaugh 1994). Except for the influence of the San Andreas Fault activity, the Sonoran Desert is relatively seismically quiet, with noticeable earthquakes felt less than once per few decades. The area subject to the most prevalent seismic activity in the region generally runs parallel to the Colorado River and along a northwest to southeast trending zone through Yuma.

Although the BMGR is generally regarded to be in a tectonically stable area with low levels of seismic activity and few active faults, seismic activity is prevalent just outside the BMGR boundaries. In fact, Yuma is rated as having the highest earthquake hazard in Arizona, primarily because it is located close to the active faults in southern California and northern Mexico. Two faults occur near the BMGR—the 11-mile long Algodones Fault, which is located near Yuma, and the two-mile long Sand Tank Fault, which is located approximately six miles southeast of Gila Bend. The estimated maximum magnitudes for the Sand Tank and Yuma Faults are 6.5 and 7.0 on the Richter Scale, respectively (Pearthree and Bausch 1999).

4.2.1.2 Mineral and Energy Resources and Withdrawal Status

Southwestern Arizona was one of the earliest and most important mineral producing areas in the state. Numerous large and small hardrock and placer mining operations, first prospected during the mid- and late-1800s, are located on and adjacent to the BMGR. Mining was active on portions of the BMGR until the area was originally withdrawn for military use in 1941. Since this time, however, mineral prospecting and mining have been excluded from the BMGR. There is no active mining and there are no active mining claims or other valid existing mineral rights within the BMGR. The remnants of this past mining activity, such as old prospects and developed mining operations, are found throughout the BMGR, but are particularly prevalent in the Sand Tank, Gila, and Copper mountains. These abandoned mines, listed on Table 4-3, are further addressed in other sections of this EIS as they are important historic, recreation (i.e., public interest sites), and biological resources (e.g., habitat for bats and other wildlife). Some of the mines are also eligible for inclusion on the National Register of Historic Places.

The BMGR area contains numerous varied occurrences and deposits of metalliferous and nonmetalliferous minerals as well as energy resources. Several metallic mining districts (designated areas determined by type of mineralization and age of the mineral resource deposits) are located on or near the BMGR. The Fortuna Mining District, which includes only one major economic mineral deposit (gold with minor amounts of copper) covers the central part of the Gila Mountains. Gold, silver, and copper were once mined in the La Posa Mining District, which includes the Wellton Hills. The Mohawk Mining District, which includes the Mohawk Mountains, contains porphyry copper deposits. Other known or potential mineral resources on the BMGR include tungsten, molybdenum, mica, tin, rare earth elements (a special class of 14

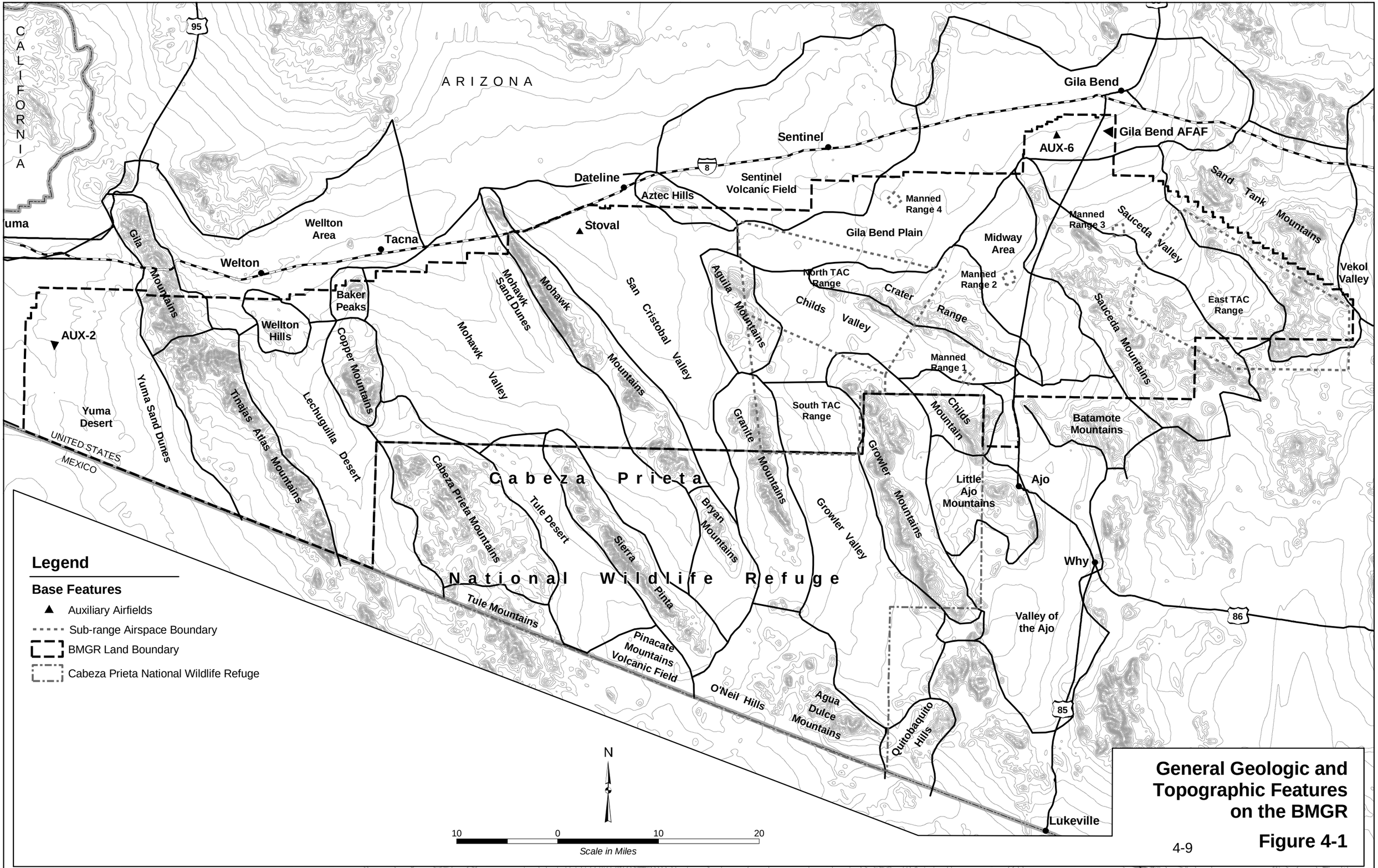
TABLE 4-2
TEN MAJOR GEOGRAPHIC FEATURES ON THE BMGR

Feature	Description
Mountain Ranges	There are 17 mountain ranges located wholly or in part on the BMGR (see Figure 4-1). These ranges typically rise 1,000 to 2,000 feet above the adjacent valley floors. The highest and most extensive uplands area within the BMGR occurs within the Sand Tank and Sauceda mountains complex, located in the northeastern most portion of the range. The highest elevation in this complex is 3,667 feet MSL at Dragon's Tooth Mountain, located in the southern portion of these mountains. Other peaks within this complex reach 2,818 and 2,949 feet MSL. In comparison, peak elevations in the Crater Range and the Aguila, Mohawk, and Gila mountains—moving from east to west—are 1,749, 1,801, 2,776, and 3,156, respectively. The mountains of the BMGR are of two physiographic types, sierras and mesas (Spanish for "table"), depending on their origin. Sierra-type mountains, primarily composed of crystalline granite and metamorphic rock and having a jagged and sharply crested profile, are the more predominant types. Numerous, relatively old stream channels are cut deep into these mountains. The Mohawk and Granite mountains are examples of the sierra type. Mesa mountains are composed of basaltic rock and are blocky and uniform in shape and relatively flat on top. The stream channels that cut through these mountains are relatively young. Examples include the Growler and Aguila mountains.
Volcanic Landforms	Although the mesa-type mountains are volcanic landforms, they generally lack the morphological features commonly associated with volcanoes. However, other areas of the BMGR manifest more obvious volcanic landforms. The most notable is the Sentinel Plain Volcanic Field. Although now dormant, this area exhibits cones, lava flows, and volcanic remnants from the active period about three million years ago. More details about the Sentinel Plain is included under the subheading "Geology, Topography, and Soils with Distinct Geographic Areas of the BMGR." Other volcanic landforms such as calderas are dispersed throughout the range. Rocks almost entirely composed of volcanic flows and tuff (consolidated ash) are found in the Crater Range and the Sauceda, Sand Tank, Aguila, and Growler mountains. Raven Butte, on the eastern flank of the Tinajas Altas Mountains, is another prominent volcanic land form composed of a series of thin, flat-lying basalt flows overlying granitic rock.
Pediments	Just as one set of geological processes creates volcanoes and mountains, counter-processes erode these features. The major erosional features at the base of the mountains are pediments—broad, gently sloping surfaces extending from the abrupt contact of the mountains with the valley floor primarily formed by water erosion. The pediment formation is a smooth, eroded bedrock surface formed over time and often covered with a thin, discontinuous, alluvial veneer. Pediments are most common in BMGR—East.
Alluvial Fans and Bajadas	Alluvial fans and bajadas (ba-HA-da, Spanish for "that which is below") differ from pediments in that these geologic features are formed by depositional processes. Rare heavy rains produce torrents of mud, rocks, and vegetation that cascade rapidly down steep narrow canyons in the mountains. This debris spreads out along mountain fronts into cone-shaped masses called alluvial fans because when viewed from above appear as fans-shaped wedges. When several alluvial fans generated from successive mountain canyons laterally coalesce, the resulting composite feature is called a bajada. Bajadas may be hundreds to thousands of feet thick, and may hold deposits of water deep beneath the surface. More than 50 percent of the valley floor area within BMGR is composed of alluvial fans and bajadas.
Valleys	The basins or valleys of the BMGR, like the bajadas, are composed of alluvial sediment. The sediment contained within these basins has been deposited over many years, beginning with the Pliocene Epoch, and is increasingly older with depth. The fill is unconsolidated to moderately consolidated silt, clay, sand, and gravel deposits, which varies in depth from a few hundred feet in the northeast portion of the BMGR to more than 10,000 feet deep in the Yuma Desert. The lowest valley elevation, about 200 feet MSL, occurs in the western portion of the BMGR within the Yuma Valley.
Washes	The highly ephemeral precipitation regime of the BMGR area has led to the development of drainage patterns within the alluvial valley of the BMGR that are characterized by shallow washes or arroyos. Ephemeral drainage emanating from the mountain areas, typically flows in a radial parallel pattern until they coalesce into larger washes that flow along the main axes of the valleys. Most of the BMGR watershed drains north to the Gila River, which flows west into the Colorado River, and which in turn flows south into the Gulf of California. The exception is the Yuma Desert, at the far Western end of the range, which drains directly into the Colorado River or Gulf of California.

TABLE 4-2
TEN MAJOR GEOGRAPHIC FEATURES ON THE BMGR

Feature	Description
Playas	While most of the washes on the BMGR ultimately drain into either the Gila or Colorado rivers or directly to the Gulf of California, a few drainages are internally closed basins, or playas. Playas are typically flat, with a gradient of less than one percent. Playa surfaces are often composed of impermeable or nearly impermeable lenses of clay, silt, sand, and soluble salts and can temporarily form lakes in response to ephemeral rainfall.
Dunes	Sand dunes have formed in some areas of the BMGR as a result of fine sand and silt particles transported by wind. The semi-stabilized dunes of the BMGR derive large quantities of sand from Colorado River delta sediment, the same sediment source of the dunes in southeast California (e.g., the Algodones Dunes) and northwest Sonora (e.g., the Gran Desierto Dunes). The most notable dune areas on the BMGR are the Yuma Dunes (part of the Gran Desierto Dune complex), located in the south-central portion of the of the Yuma Desert, and the Mohawk Dunes, located parallel to and about three miles west of the Mohawk Mountains. Drifting sand accumulation in the southwest Sentinel Plain area probably originated from Gila River channel deposits.
River Terraces	Ancient river terraces are the bench-like topographic features found more or less parallel to present-day rivers. Because terrace deposits are primarily composed of river gravels, they are fairly porous and permeable. These terraces are particularly evident in the northwest corner of the BMGR in an area known as the Yuma Mesa. The terraces and mesas are nearly flat and are about 70 to 80 feet higher than the floor of the Gila Valley to the north. Additional river terraces associated with the Gila River are found along the northern portions of the BMGR south of Tacna and Wellton, Arizona.
Caves	A few small, naturally occurring caves are scattered throughout the BMGR. These caves consist of voids, cavities, or recesses within a cliff or ledge that is large enough to permit an individual to enter. There are no known caves with interlocking passages, such as the deep and long limestone caves found in other portions of the Sonoran Desert.

Sources: U.S. Air Force 1986, U.S. Geological Survey (USGS) 1977 and 1982



General Geologic and Topographic Features on the BMGR

Figure 4-1

TABLE 4-3
MINE SITES OF CONCERN ON THE BMGR

Site Name	Characteristics			
	Adits Number and Depth	Shaft Number and Depth	Number of Shallow Prospects	Wildlife Use or Other Specifications
Site 012 - Golden Dream Mine	one 30-ft.			used by bighorn sheep
Site 013	one 10-ft.			
Site 014 - Pool Mica Mine	one 15-ft.		several	
Site 016 - Fortuna Mine	one 50-ft.	one 1,000-ft. one 15-ft.		
Site 016 A	one 250-ft. one 70-ft.		2	250-ft. adit used by maternity colony of bats 70-ft. adit used as night roost by bats
Site 016 B	one 10-ft. one 15-ft. one 20-ft. one 50-ft.	one 15-ft. one 20-ft.	9	
Site 016 C	one 10-ft. one 20-ft. one 50-ft.	two 10-ft. one 30-ft. one 50-ft.	4	two shafts and 50-ft. adit had water
Site 016 D		three 10-ft. two 50-ft.	4	50-ft. shafts used as day roost by barn owls
Site 016 E	two 100-ft.			open on both ends, used as night roost by bats
Site 016 F	one 15-ft.	one 15-ft. one 20-ft.	11	
Site 016 G	four 6- to 50-ft.	five 10 to 30-ft .	31	some night roosting in adits by bats
Site 016 H		one 15-ft.	2	minor drifting
Site 016 I	one 25-ft.	one 10-ft. one 40-ft. one 50-ft.	6	evidence of night roosting in adit by bats
Site 017	one 12-ft.	one 5-ft. one 8-ft.		
Site 020 - Double Eagle	one 50-ft. one 20-ft.	one 100-ft winze	6	minor use by bats

TABLE 4-3
MINE SITES OF CONCERN ON THE BMGR

Site Name	Characteristics			
	Adits Number and Depth	Shaft Number and Depth	Number of Shallow Prospects	Wildlife Use or Other Specifications
Site 020 A	six 20- to 90-ft.	one 20-ft. shaft	several	evidence of night roost use by bats
Site 021 - McMahan Mine	one of unknown depth		1	evidence of night roost use by bats
Site 022 - Donaldson Mine	one 40-ft.	one 20-ft.	1	evidence of night roost use by bats in adit
Site 023 - Wellton Hills Mine	one 40-ft. one 30-ft.		1	both adits used by *Macrotus* possibly year round
Site 024 - Northern Mine		one 20-ft.	2	
Site 025 - Poorman Mine	one 10-ft.	one 30-ft. one more than 50-ft. one more than 200-ft.	11	deepest shaft used by *Macrotus*
Site 026 - Shirley Mae Mine	one 30-ft.			evidence of night roost use by bats
Site 027		one of unknown depth		
Site 028 - Smith Mine		two 30-ft. one of unknown depth		few bats observed; however, potentially important roost site shaft has drifts at 20 and 50 ft.
Site 029 - Wanamaker Mine		one 30-ft.		minor night roost use by bats
Site 030		one 40-ft.	5	
Site 031		one of unknown depth		night roosting by bats, barn owl nest site
Site 039 - Betty Lee Mine	four 30- to 400-ft.	one 700-ft.		*Macrotus* and *Myotis* present; may be important to bats; main shaft filled/covered with 100-ft. winzes
Site 039 A to G	one 10-ft. one 20-ft. two 30-ft. one 100-ft.		3	100-ft. adit used by bighorn sheep 30-ft. adit has 10-ft. drifts

TABLE 4-3
MINE SITES OF CONCERN ON THE BMGR

Site Name	Characteristics			
	Adits Number and Depth	Shaft Number and Depth	Number of Shallow Prospects	Wildlife Use or Other Specifications
Site 040 - Chicago	four 10- to 15-ft.			
Site 040 A,B	one 93-ft.		1	adit used by *Macrotus*
Site 040 E	one 10-ft.			
Site 041 - Old Soak Mine	one 20-ft. one 50-ft.	one 30-ft. decline one 60-ft. decline		
Site 043	one 150-ft. one 45-ft.	50-ft. winze 30-ft. winze		150-ft. adit shows regular use by *Macrotus* and *Myotis*
Site 043 A, B	one 30-ft.	one 15-ft.		light night roosting use of adit by bats
Site 043 C, D	one 20-ft.		1	
Site 043 E, F	one 40-ft. one 30-ft.	40-ft winze		possible maternity roost of *Macrotus* and *Myotis*
Site 043 I, L, M, N	one 10-ft. one 20-ft.	one 150-ft.	1	
Site 043 J, K	one 50-ft. one 10-ft.			night roost for bats in 50-ft. adit, bighorn sheep use
Site 043 O, P		one 150-ft.	several	
Site 043 Q		one 170-ft .		two drifts at 70 ft.—one to 90 ft. and one to 100 ft. may connect to 43O *Macrotus* winter roost
Site 044		one 30-ft.		evidence of night roosting by bats
Site 045 A	one 30-ft.			
Site 045 B		one 10-ft.		
Site 045 C	one 35-ft.			
Site 046 - Red Cross Mine	two 10-ft.	four 20- to 40-ft.		some drifting possible maternity colony of *Macrotus* and *Myotis*
Site 047 - Tavasci or Victoria Mine	one 20-ft.			

TABLE 4-3
MINE SITES OF CONCERN ON THE BMGR

Site Name	Characteristics			
	Adits Number and Depth	Shaft Number and Depth	Number of Shallow Prospects	Wildlife Use or Other Specifications
Site 053		one more than 50-ft.		
Site 061		one 10-ft.	1	
Site 062		one 30-ft.	1	
Site 065 - Lord Will #2	one 10-ft. one 40-ft.	one 20-ft.		minor night roosting of bats in 40-ft. adit
Site 147	one 200-ft.			*Macrotus* winter roost
Site 147 A to E	one 15-ft. two 30-ft.	one 25-ft.	8	one of the 30-ft. adits angles down to water
Site 155 - Cresent #1,2 Golden King	one 50-ft.			

metallic minerals), and aggregate. Minerals that are known as strategic and critical because they could decrease and/or preclude the dependence of the United States on foreign sources of supply in times of national emergency are also known to occur on the BMGR. Based on the earth's physical properties, several areas have been identified on the BMGR where there could be a source of geothermal energy. Oil and gas exploration has not occurred within the range so it is not known if these energy resources exist on the range. However, oil and gas exploration occurred without success just west of the range near Yuma (U.S. Air Force 1999).

A mineral and energy resource assessment was prepared for the 1999 renewal of the BMGR land withdrawal under the direction of the BLM. This report (ARCADIS Geraghty & Miller 1998a) should be consulted for detailed information regarding mineral and energy resource potential on the BMGR.

4.2.1.3 Soils

A variety of soils, ranging from fine-grained sands and silts on the valley floors to very gravelly soils in the mountainous regions, have formed on the BMGR. Soils perform a number of critical physical, chemical, and organic processes that are essential to the biological productivity and ecological health of the range. Soils, for example, provide rooting material for plant support, function as reservoirs for water and nutrients, provide thermal protection to plant roots and burrowing animals, serve as animal shelters from predatory and surface weather threats, and absorb and neutralize natural organic wastes and debris. Because of their susceptibility to physical disturbance and slow recuperative powers, desert soils are fragile to some forms of impact.

All of the soils on the BMGR fall within two taxonomic soil orders, Aridisols and Entisols. Aridisols are soils of arid regions that exhibit at least a minimal amount of subsurface horizon development. They usually occur on the high to intermediate alluvial fans that flank major mountain ranges. Entisols are younger soils that are developed in unconsolidated parent material. They are often formed from freshly deposited or heavily reworked material. Flood deposits and sand dunes are good examples of Entisols (U.S. Air Force 1986).

Previous soil classification surveys for the BMGR have been limited to the taxonomic level of soil associations. Soil associations define general soil types occurring together in a characteristic pattern over a geographic region. Soil associations may be further divided into series, which are groups of soils having similar differentiating characteristics and arrangement in the soil profile. Within each soil association there may be several or many different soil series, and these may differ in erosion susceptibility and recovery potential. A series is generally considered the basic unit of the soil classification system. The BMGR is included in the General Soils Maps for Maricopa, Pima, and Yuma counties produced by the Natural Resources Conservation Service (NRCS) (formerly Soil Conservation Service [SCS]). Terminology used in the three different

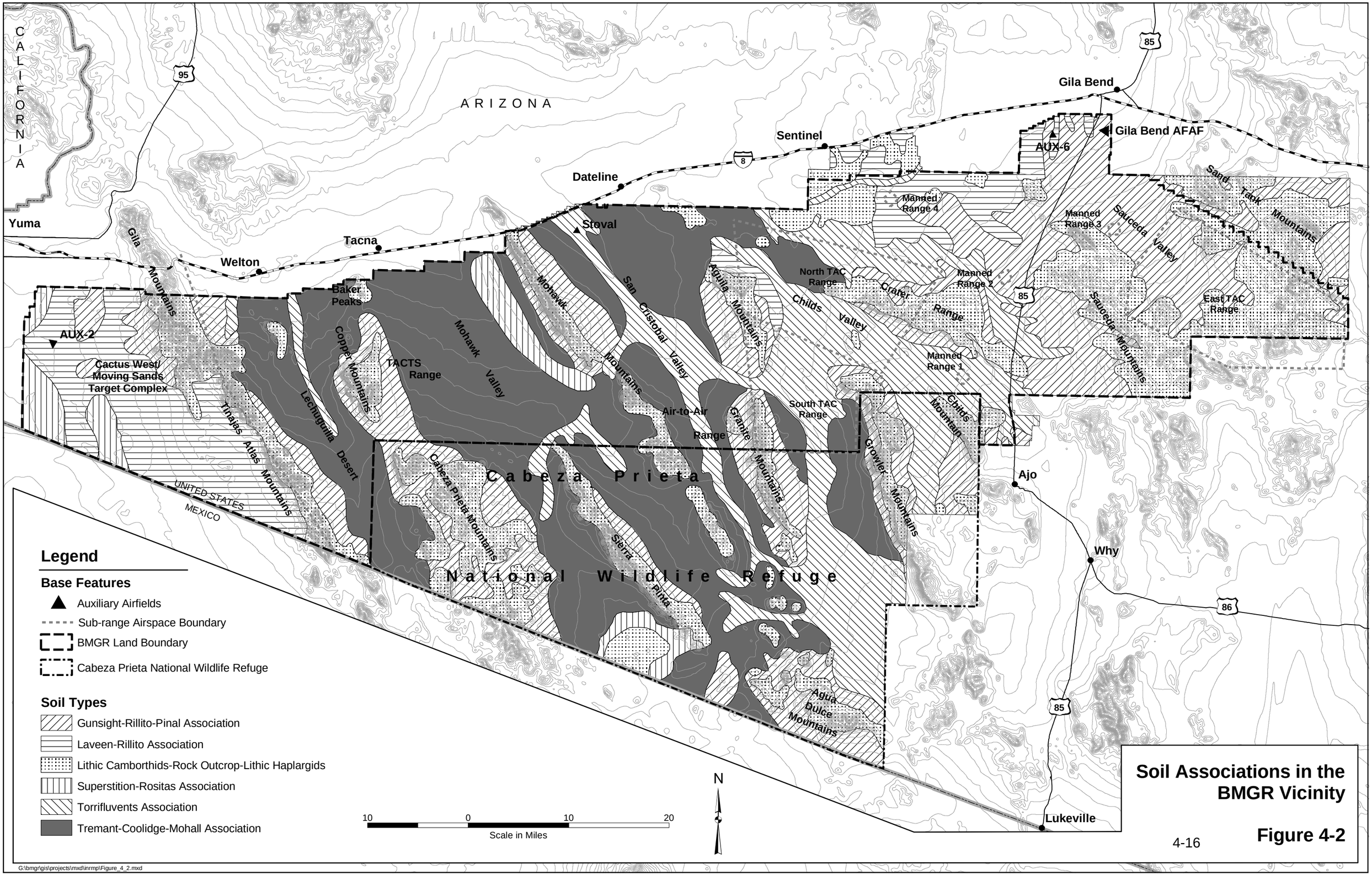
county Soils Maps differs, with the authors using different terms for what appear to be the same soil associations. An attempt at synthesis and simplification was made in the 1986 Natural Resources Management Plan, which reduced the number of associations on the range to six, and gave consistent names to them. Figure 4-2 graphically represents the location and extent of the various soil associations on the BMGR. Descriptions of the soil map units and associations are shown on Figure 4-2 and their water and wind erosion hazards are presented in Table 4-4.

TABLE 4-4
SOIL MAP UNITS AND EROSION HAZARDS

Map Unit	Erosion Hazard	
	Water	Wind
Torrifluvents Association • loams, sandy loams, silt loams, and gravelly sandy loams • on nearly level to gently sloping floodplains, valley floors, and low alluvial fans	slight to moderate	moderate to severe
Gunsight-Rillito-Pinal Association • gravelly loams, gravelly sandy loams, and very gravelly loams • on alluvial fans and drainage ways	slight	none
Laveen-Rillito Association • loams, gravelly sandy loams, and fine sandy loams • on stream terraces and low fan terraces	slight	none
Lithic Camborthids-Rock Outcrop-Lithic Haplargids Association • very cobbly to cobbly loams, very stony to stony loams, gravelly very fine sandy loams, and rock outcrops • on low mountains, hills, and mountain ridges	slight	none
Tremant-Coolidge-Mohall Association • gravelly loam, sandy loam, and sandy clay loam • on alluvial fans and low terraces	slight to moderate	none
Superstition-Rositas Association • loamy fine sand and fine sand • on plains, mesas, terraces, and sand dunes	slight	severe

Source: SCS 1972, 1974a, 1974b, and 1980; U.S. Air Force 1986; NRCS 1997

The physiochemical characteristics of the soils affect susceptibility to water and wind erosion, infiltration and permeability, available water capacity, salinity, alkalinity, and pH (a measure of acidity or alkalinity). Erosion hazards, determined by NRCS for the soil map units in the soil survey, predict the susceptibility of soil units to accelerated erosion when disturbed.



Soil Associations in the BMGR Vicinity

Figure 4-2

Susceptibility to erosion is also related to the presence or absence of protective coverings, such as desert pavements and vegetation. Water erosion potential typically increases with greater slope while wind erosion potential is greatest where soils are fine-grained sands and silts. Many of the valley soils are subject to moderate or high wind erosion potential. In some of the valleys, rainfall runoff has cut small channels into the soil in a process called rill erosion. Gullies have formed where these channels have enlarged and cut more deeply into the soil.

Three important desert soil surfaces—desert pavements, rock varnish, and microphytic soil crusts (characterized by the growth of microscopic organisms; also known as cryptogamic or cryptobiotic)—are especially fragile. In the case of desert pavements and rock varnishes, the fragility is related to a susceptibility to disruption of a surface that has taken many years to form and will take many years to recover. The properties of microphytic soil crusts actually make soils less susceptible to erosion, but are also easily damaged and not quick to recover. Natural disruptive occurrences (such as floods, heavy rains, or hail) do not affect these soil surfaces as dramatically as unnatural occurrences, such as even a single pass of a heavy vehicle or the chipping away of a rock varnish to uncover the lighter internal rock color.

Desert pavements are large, flat, conspicuous areas devoid of vegetation and covered by a layer of tightly packed small stones. They are frequently very dark-colored and in many cases they are nearly black. The most extensive and well-developed areas of desert pavements occur on stony alluvial fan deposits flanking the rugged, lower mountains such as the Baker Peaks. The best-developed pavement of small stones has formed over the passage of several tens of thousand to a few hundreds of thousands of years. Although it was previously thought that desert pavements were formed through the selective erosion of fine material from the surface by wind or water erosion, the process is now better understood as a result of research conducted within the last 15 years (Phillips and Comus 2000). It is now thought that, with a few exceptions, desert pavement is formed through a process of physical weathering and the accumulation of a porous mineral layer in the soil that separates and levels the desert pavement surface from the underlying, uneven rocky material. Physical weathering of large rock on the surface produces the small stones that eventually form the pavement surface. These smaller stones tend to accumulate in topographic lows on the original, uneven surface. As continued physical weathering of the surface stones further reduces their sizes, fine-grained soil, typically a few centimeters thick and consisting mostly of silts and clays, accumulates beneath the layer of surface stones, separating those stones from the rest of the underlying rocky material. Over time, the further accumulation of fine-textured materials laterally lifts the mono-layer of stones of the pavement and levels the surface. Additional weathering of surface stones reduces their sizes and eventually yields a surface of uniformly small rock fragments. Desert pavements are vulnerable to damage that disrupts this uniformity and the veneered surface that takes so many years to form (Phillips and Comus 2000).

Rock varnish, frequently called desert varnish, is found on stone surfaces and provides the dark complexion of the small rocks that comprise desert pavement as well as large rock and boulder

surfaces, despite the internal color of the rock. The glossy coatings of desert varnish on stones are very thin, at most a few hundredths of a millimeter thick (about the thickness of a sheet of paper). The formation of rock varnish is poorly understood. Many of the mineral ingredients of varnish, including clays and manganese, are probably derived from airborne materials that settle on rock surfaces. Bacteria residing on the rock surface may play a role in concentrating and cementing the materials to form the glossy coatings. Rock varnish forms very slowly and is extremely sensitive to disturbance. Rock surfaces that resist weathering develop varnish coatings that are increasingly thick and dark. The thickest, darkest coatings of varnish found on older deposits may have been accumulating for many tens of thousands to more than 100,000 years. Disturbance to darkly varnished desert pavements, which take so long to form, can last for centuries as evidenced by the intaglios that were created by ancient peoples by removing dark varnished stones and exposing the underlying light-colored soils that are still evident today (Phillips and Comus 2000).

Small portions of the BMGR have thin, living microphytic soil crusts that considerably affect soil properties. Desert soil crusts are formed from very small living organisms consisting of cyanobacteria (or "blue-green algae") along with other algae, lichens, mosses, fungi, and bacteria. These dark cyanobacteria crusts lie dormant most of the time but are physiologically "awakened" when the soil surface is wetted. After a rain, these organisms typically remain active for only a day or two before the soil surface again dries. Cyanobacteria create sticky materials that bind soil particles together. Threadlike structures, produced by the symbiotic fungi of lichens, knit the soil together making it more resistant to erosion by the intense splashes of thunderstorm raindrops. Cyanobacteria can fix atmospheric nitrogen, thereby adding nitrogen to the soil in a form that can be used by larger plants. While soil crusts increase soil stability, they are susceptible to damage. Like desert pavements, these living crusts can be destroyed by human activities and recovery can be very slow, taking decades to perhaps a century or more (Phillips and Comus 2000).

4.2.1.4 Geology, Topography, and Soils with Distinct Geographic Areas of the BMGR

As shown on Figure 4-1, the BMGR can be divided into 22 main and/or distinct geographic areas. A detailed geographically based description of each of these areas is provided here so that the resource management implications of the alternative INRMP management strategies discussed in this EIS can be easily referenced by area.

1. Yuma Desert and Sand Dunes. The Yuma Desert and Sand Dunes area (see Figure 4-1) has both the lowest elevation on the BMGR, about 200 feet MSL, and deepest alluvial deposits, about 10,000 feet thick. In general, the elevations in this area are lowest in the west and gradually rise to the east to about 500 feet MSL where alluvial fans have developed outward from the Gila and Tinajas Altas mountains. Washes have developed in turn to drain these fans and the upland mountain areas further east. The most predominant of these is the Fortuna Wash,

which drains northward to the Gila River (USGS 1977). Other washes drain from the Yuma Desert to the west to the Colorado River or southwest to the Gulf of California. The Yuma Mesa is prevalent in the northwest corner of the BMGR and rises from the valley floor to about 300 to 350 feet MSL. The soils on the Yuma Mesa are primarily of the Superstition-Rositas Association.

The Yuma Sand Dunes occur in the south-central portion of the Yuma Desert. These dunes comprise the northern portion of the Gran Desierto dune system, the largest active dune system in North America. The majority of this dune system is located in Sonora, Mexico, and covers about 1,150,000 acres (U.S. DOI, BLM 1990b). The Gran Desierto contains giant examples of fully mature star dunes, with several radiating sharply crested sand ridges coming off a high point. Large dunes in the Gran Desierto system may tower as high as 600 feet above the desert floor.

The soil associations of the plains, mesas, terraces, and sand dunes of this area are primarily of the Laveen-Rillito Association, including those of the Yuma Dunes. The Superstition-Rositas Association, while also interspersed within the Yuma Dunes, occurs principally in the westernmost portion of the Yuma Desert. This association is considered to have a slight water erosion hazard and a severe wind erosion hazard. The alluvial fan that extends westward from the Gila Mountains into the northern Yuma Desert contains soils principally from Gunsight-Rillito-Pinal Association, which is slightly susceptible to water erosion.

2. Gila Mountains and Vopoki Ridge. The Gila Mountains are sharply angular and have steep, jagged peaks that, for the most part, are at or above 2,000 feet MSL in elevation. This range extends south-southeast from Telegraph Pass at Interstate 8 for about 17 miles into the interior of the BMGR—West to the Cipriano Pass located between the Gila and Tinajas Altas mountains (see Figure 4-1). Sheep Mountain rises to 3,156 feet MSL along the eastern portion of this range. Massive rocks and boulder debris lie at the foot of the Gila Mountains, transported during infrequent but intense rains. The mountains were formed during active periods of volcanic activity, which ejected ash-flow material from long, thin fissure vents (Phillips and Comus 2000). The distinct, lower, thinner and more rugged Vopoki Ridge descends southward off the southwestern end of the Gila Mountains. The soils in the Gila Mountains and Vopoki Ridge are of the Lithic Camborthids-Rock Outcrop-Lithic Haplargids Association and are slightly subject to water erosion.

3. Tinajas Altas Mountains, Butler Mountains, and Davis Plain. The Tinajas Altas Mountains are classic sierra-type mountains that follow the north northwest-to-south southeast trend of the Gila Mountains from Cipriano Pass for about 13 miles to the international border (see Figure 4-1). At roughly the same elevation as the Gila Mountains, the Tinajas Altas Mountains rise more abruptly from the valley floor in dramatic angular forms. Cipriano Pass and Tinajas Altas Pass, located along the mountain chain about 4 miles north northwest of the international border, are important breaks in this otherwise generally obstructive landform. Raven Butte, a volcanic

caldera located just south of Cipriano Pass on the eastward face of the mountains (see Figure 4-1), has a rounded peak and steep slopes that contrast sharply both physiographically and visually with the Tinajas Altas Mountains. Like the Gila Mountains, the predominant soil association found in the Tinajas Altas Mountains is the Lithic Camborthids-Rock Outcrop-Lithic Haplargids Association and thus the soils in these mountains have a slight potential for water erosion.

The Butler Mountains, located about four miles west of the Tinajas Altas Mountains and the intervening Davis Plain alluvial-filled valley and bajada form a subset basin-and-range environment (see Figure 4-1). The Butler Mountains, though south of Vopoki Ridge, fall along a similar trend and rise to about 1,100 feet MSL (USGS 1977). The soils in the Butler Mountain and Davis Plain area are characterized as primarily of the Laveen-Rillito Association and thus have a slight potential for water erosion.

4. Lechuguilla Desert and Wellton Hills. The broad alluvial valley between the Gila and Tinajas Altas mountain chain and the Copper and Cabeza Prieta mountains to the east is the Lechuguilla Desert (see Figure 4-1). The floor of this valley lies primarily at about 400 feet MSL but rises slightly to about 500 feet MSL in some areas. The many washes that drain this valley form a herring bone pattern that drains away from the mountain ranges to coalesce along the central valley axis. The central drainage, Coyote Wash, drains to the north to the Gila River. Coyote Wash is more than a mile wide in some areas (USGS 1977). Along the eastward front of the Gila and Tinajas Altas mountains and along the western front of the Copper Mountains, the Gunsight-Rillito-Pinal Soil Association, which has a slight potential for water erosion, is most prevalent. The majority of the Lechuguilla Desert has soils of the Tremant-Coolidge-Mohall Association, which are subject to slight to moderate water erosion. The Coyote Wash and other major washes draining the Gila Mountains, however, are primarily of the Torrifluvents Association and are thus more susceptible to both wind and water erosion.

The mesa-type volcanic Wellton Hills are located a few miles south of the northern boundary of the BMGR, directly south of the Town of Wellton (see Figure 4-1). This landform has a relatively indistinct ridgeline that reaches an elevation of 1,192 feet MSL at its highest point (USGS 1977). The slopes consist of a combination of eroded and smooth faces and are predominantly dark brown in color. The Wellton Hills are of the Lithic Camborthids-Rock Outcrop-Lithic Haplargids Association and the potential for water erosion to these soils is slight.

5. Baker Peaks. These mountains, which are located just south of the BMGR boundary and southwest of the Town of Tacna (see Figure 4-1), have steep dissected slopes and a dark brown volcanic rocky surface. These low-elevation mountains reach 1,366 feet MSL (USGS 1977) and are composed of soils of the Lithic Camborthids-Rock Outcrop-Lithic Haplargids Association, which has a slight potential for water erosion and no potential for wind erosion.

6. Copper Mountains. These rugged mountains, located about six miles south of the Baker Peaks (see Figure 4-1), display numerous rock outcrops and the most developed pediment of all BMGR—West mountains. Late-Mesozoic-aged rocks are found in the Copper Mountains. The highest point in these mountains, Coyote Peak, reaches an elevation of 2,808 feet MSL (USGS 1977). The soils of the Copper Mountains are principally characterized as of the Tremant-Coolidge-Mohall Association, which have a slight to moderate potential for water erosion.

7. Mohawk Valley and Sand Dunes. The Mohawk Valley extends eastward from the Copper Mountains and Baker Peaks to the Mohawk Mountains (see Figure 4-1). This alluvial valley is filled with sediments transported from these ranges as well as from the Sierra Pintas to the south and Cabeza Prieta Mountains to the southwest (the Cabeza Prieta Mountains ostensibly occur entirely within the Cabeza Prieta NWR). The Mohawk Valley is not as highly dissected by washes as the other BMGR valleys, nor is one central wash the predominant outflow. Mohawk Wash, the most substantial drainage, begins between the Cabeza Prieta Mountains and Sierra Pintas in the Cabeza Prieta NWR and extends northward where it dissipates into multiple, indistinct small channels due to the low northward gradient (USGS 1982). The Mohawk Wash reforms further to the north and east of Tacna before emptying into the Gila River. Mohawk Valley soils along its perimeter mountain fronts are of the Gunsight-Rillito-Pinal Association, which has slight water erosion potential. The remainder of valley soils (with the exception of the Mohawk Sand Dunes) is of the Tremant-Coolidge-Mohall Association, which has slight to moderate potential for water erosion.

The Mohawk Sand Dunes, two miles across at their widest point, are one of the few major semi-stabilized sand dune systems in Arizona. Wind-dispersed sand from the Colorado River delta and possibly the Gila River channel has accumulated in a downwind position that is predominantly parallel to and about three miles west of the Mohawk Mountains. A substantial, parallel playa depression lies between the mountains and dunes. The southern extent of the dunes curves east around a pass in the Mohawk Mountains into the San Cristobal Valley. The Mohawk Dunes are the largest and least disturbed dune system in the Arizona Sonoran Desert (U.S. DOI, BLM 1990b). The Superstition-Rositas Association is the principal soil association in the Mohawk Dunes. This association is rated as having slight potential for water erosion and severe potential for wind erosion.

8. Point of the Pintas. Although the majority of the Sierra Pintas are located within the Cabeza Prieta NWR, the northern tip of the Sierra Pintas (known as the Point of the Pintas) lies just north of the refuge boundary. The Point of the Pintas, only 945 feet MSL at the highest point (which is on the refuge boundary) has jagged peaks and eroded slopes (USGS 1982). Soils in this landscape feature are predominantly of the Tremant-Coolidge-Mohall Association and are thus slightly to moderately subject to water erosion.

9. Mohawk Mountains. The Mohawk Mountains form a long, narrow range with a dominant ridge line and steep slopes that have been eroded by numerous small drainages, although few

canyons have formed. The mountains abruptly rise about 2,300 feet from a valley floor elevation of about 500 feet MSL to a high point of 2,776 feet MSL (USGS 1982). The poor canyon development of the range is a result of its young age and erosion-resistant rock composition, dry climate, and narrowness of the range drainages (U.S. DOI, BLM 1990b). The range, though discontinuous with a relatively wide pass, extends along a north northwest-to-south southeast trend from north of the BMGR boundary to south of the Cabeza Prieta NWR boundary and forms a topographic barrier roughly along the dividing line between BMGR—East and BMGR—West (see Figure 4-1). The eroded slopes contain metamorphic Precambrian rocks and rock outcrops, including Pinal Schist, Oracle Granite, and Chico Shuni Quartz Monzonite (U.S. Air Force 1986). The predominant soil association present in the Mohawk Mountains, the Lithic Camborthids-Rock Outcrop-Lithic Haplargids Association, is slightly subject to water erosion.

10. San Cristobal Valley. The San Cristobal Valley extends eastward from the Mohawk Mountains to the Aguila and Granite mountains (see Figure 4-1). The lowest portion of the valley is centrally positioned and has an elevation of about 400 feet MSL (USGS 1982). The San Cristobal Wash, the principal drainage for this valley, runs from south to north and empties into the Gila River. A major tributary to this wash is the Growler Wash, which drains the Growler Valley to the east of the Granite Mountains. The San Cristobal-Growler system collectively drains a major portion of Organ Pipe Cactus NM, Cabeza Prieta NWR, and BLM properties south of Ajo. This system, as it occurs within the BMGR and the refuge, is of significance because the very low gradient along much of its course has led to the development of a broad interlacing network of many small, branching and reuniting shallow channels, resembling in plan the strands of a complex braid. Water movement by sheet wash rather than by deep channel flow is dominant in many locations along this system, although an area of broad gully cutting is occurring where the Growler Wash bends to the northwest at its confluence with Daniels Arroyo. The sheet wash areas support areas of dense xeroriparian vegetation that exceed the densities and expanse of that exhibited along most other valley bottoms within the BMGR. The San Cristobal Wash terminates in a playa-like area at the northwest end of this valley west of Stoval Auxiliary Airfield before it exits the range (U.S. Air Force 1986). That exit is now via a culvert beneath the railroad and interstate highway on the northern range boundary.

Like the other BMGR valleys, soils at the foot of the mountains are of the Gunsight-Rillito-Pinal Association and are slightly subject to water erosion. The majority of the valley floor is of the Tremant-Coolidge-Mohall Association and thus has a slight to moderate potential for water erosion. The San Cristobal Wash area is slightly to moderately subject to water erosion and moderately to severely subject to wind erosion as the soils there are primarily of the Torrifluvents Association.

11. Aztec Hills. These low-relief volcanic hills, which reach elevations of about 1,300 feet MSL (USGS 1982), are located partially within the BMGR slightly southeast of Dateland (see Figure 4-1). The Aztec Hills have a slight potential for water erosion as the soils of this landscape feature are primarily of the Lithic Camborthids-Rock Outcrop-Lithic Haplargids Association.

12. Aguila Mountains. The Aguila Mountains are composed of two completely different types of landforms that occur within the same landscape feature (see Figure 4-1). The northern portion of the Aguila Mountains are mesa-type horizontally bedded volcanic mountains that represent the first episodes of basaltic volcanism during the Cenozoic era (U.S. Air Force 1986). They are blocky and uniform in shape with a relatively flat top surface. The mesa is gently tilted upwards toward the south to a high point of 1,800 feet MSL (USGS 1982). The southern portion of the mountain range consists of sierra-type mountains with a jagged and sharply crested profile and eroding slopes that transition into smooth rounded-top foothills at their base. There is a slight potential for water erosion of the soils that comprise the Aguila Mountains as they are principally of the Lithic Camborthids-Rock Outcrop-Lithic Haplargids Association.

13. Granite Mountains. The northern portion of this mountain range is located in the BMGR, while the southern portion is located in the Cabeza Prieta NWR (see Figure 4-1). This narrow, relatively low profile range reaches 2,490 feet MSL at its highest point (USGS 1982) and displays several sharp jagged peaks and steep eroded slopes. Mid-Tertiary granite rocks are found in the Granite Mountains (U.S. Air Force 1986). The Granite Mountains are of the Lithic Camborthids-Rock Outcrop-Lithic Haplargids Association, so the potential for water erosion to these soils is slight.

14. Sentinel Plain Volcanic Field. At 225 square miles, the Sentinel Plain Lava Flow is the largest volcanic field in southern Arizona. The 15 broad, low-aspect lava cones found in the Sentinel Plain were generated from individual eruptions that each produced a small amount of lava, and thus, the field shows only small amounts of topographical relief. The broad lava cones, which are barely discernible from a side view, have a diameter to height ratio of 40 or 50 to 1. The flows in portions of the plain surface are from relatively recent eruptions and show little sign of erosion or weathering. The plain is nearly 100 feet thick with a surface of desert pavement and rocks with desert rock varnish. The most extensive portion of the Sentinel Plain Volcanic Field is north of Interstate 8, but the southern portion of this lava flow is within the BMGR (see Figure 4-1). A part of the field lies within the portion of the BMGR that was not renewed by the MLWA of 1999. The portions of the field that continue to lie within the range together with the non-renewed area represent the portion of the entire volcanic field least disturbed by human activities (U.S. Air Force 1986; U.S. DOI, BLM 1990b). The soils of the Sentinel Plain are predominantly of the Lithic Camborthids-Rock Outcrop-Lithic Haplargids Association at higher elevations and the Laveen-Rillito Association at lower elevations. Both soil associations have a slight potential for water erosion.

15. Gila Bend Plain, Midway Area, and White Hills. The Gila Bend Plain extends southeast from the Sentinel Plain to the Crater Range and converges with the Midway Area, which is located northeast of the Crater Range and southwest of the Sauceda Mountains (see Figure 4-1). The Midway Wash drains this basin to the north. The predominant soil association, Gunsight-Rillito-Pinal, has a slight water erosion hazard.

The White Hills are located about 20 miles southwest of Gila Bend on the west side of State Route 85 and rise to 1,430 feet MSL at their highest point (USGS 1982). A few relatively rare types of lava cones and volcanic remnants are located immediately east of the White Hills (e.g., Black Gap). The only other place in Arizona where these types of lava cones are found is north of the Colorado River (U.S. Air Force 1986). The soils of the White Hills are of the Lithic Camborthids-Rock Outcrop-Lithic Haplargids Association, and thus are potentially subject to slight water erosion.

16. Crater Range. This heavily eroded mountain range of primarily volcanic material has jagged peaks and ridges exhibiting rock outcrops and a variety of eroded and smooth slopes. The Tertiary-aged volcanic landforms stand at 1,749 feet MSL at their highest point (USGS 1982). Located 27 miles southwest of Gila Bend, the eastern portion of this mountain range is traversed by State Route 85 (see Figure 4-1). The predominant soil association of the Crater Range, the Lithic Camborthids-Rock Outcrop-Lithic Haplargids Association, is subject to slight water erosion.

17. Childs Valley. The Childs Valley lies east of the Aguila Mountains, north of the Growler Mountains and Growler Valley, and south of the Crater Range (see Figure 4-1). Ten Mile Wash, which drains north to the Gila River, is the predominant drainage. A small playa is located in Childs Valley southeast of the Aguila Mountains (U.S. Air Force 1986). There is more erosion potential in Childs Valley than the valleys of BMGR—West because the Torrifluvents Association, which covers most of the valley floor, has a slight to moderate water erosion hazard and a moderate to severe wind erosion hazard.

18. Growler Mountains. Much of the Growler Mountains, including the 3,018-foot Growler Peak, is located within the Cabeza Prieta NWR. The dominant ridge line and eroding escarpments of these mountains transition into smooth slopes and rounded foothills near the west-facing mountain front. This volcanic landform is representative of the first episode of basaltic volcanism of the Cenozoic Era. Volcanic rocks and Quaternary-aged landslide deposits are found in the Growler Mountains (U.S. Air Force 1986). The soils of this mountain range are subject to slight water erosion as they are principally of the Lithic Camborthids-Rock Outcrop-Lithic Haplargids Association.

19. Childs Mountain. This landform is located mostly within the Cabeza Prieta NWR; however, the north and eastern side of the mountain lies within the BMGR. There are several large, flat plateaus that appear to step up the eastern side of the mountain, while the western side is relatively steep and eroded. The soils of this mountain have a slight water erosion hazard as they are of the Lithic Camborthids-Rock Outcrop-Lithic Haplargids Association.

20. Sauceda Valley. The Sauceda Valley is nestled between the high-relief Sand Tank and Sauceda mountains (see Figure 4-1), from which rainfall is quickly transported to a developed wash system in the valley floor through well-established mountain channels. The dominant

washes providing drainage to the north and east toward the Gila River are the Quilotosa Wash, which primarily drains the Sand Tank Mountains, and the Sauceda Wash, which primarily drains the Sauceda Mountains. The soils, grouped in the Gunsight-Rillito-Pinal Association, have a slight water erosion potential.

21. Sauceda Mountains. The Sauceda Mountains (see Figure 4-1) display a combination of dominant peaks with jagged ridge lines and eroded slopes interspersed with volcanic plateaus such as the Blue Plateau and Hat Mountain. The front of the mountains has developed pediments transitioning into alluvial fans. The highest point in the Sauceda Mountains is Tom Thumb Peak at an elevation of 2,818 feet MSL (USGS 1982). The soils of the Sauceda Mountains are potentially subject to slight water erosion as they are generally of the Lithic Camborthids-Rock Outcrop-Lithic Haplargids Association.

22. Sand Tank Mountains. The Sand Tank Mountains, located in the easternmost extent of the military range (see Figure 4-1), are the highest mountains on the BMGR (Dragon's Tooth Mountain reaches an elevation of 3,667 feet MSL). Middle-Precambrian Apache Group rocks, intruded by igneous rock of similar age, are found in the central Sand Tank Mountains and Paleozoic outcrops are concentrated in the low-lying areas of these mountains. The peaks exhibit jagged ridge lines, while the slopes are highly eroded. The foothills, underlain by a pediment, are quite uniform in form. There are several areas where the volcanic features are apparent and volcanic rocks are found throughout the Sand Tank Mountains. The soils of these mountains are subject to slight water erosion as they are principally of the Lithic Camborthids-Rock Outcrop-Lithic Haplargids Association.

4.2.2 Interrelationship Between the Military Mission and Earth Resources

This section describes how earth resources are interrelated with the military mission of the BMGR—ranging from the direct use of select areas to the value of varied terrain, one of the greatest assets of the BMGR as an aviation training range. The 60-year legacy of military use of the BMGR has influenced the existing conditions of the resource, including the widespread protection afforded by the withdrawal status. As stewards to the BMGR, the Air Force and Marine Corps strive to eliminate or minimize the impacts to earth resources that result from the existing or potential future activities that are required to support their military missions.

4.2.2.1 Varied Terrain

The basin and range topography of the BMGR provides diverse air-ground combat challenges for aircrews. Simulated military targets, such as airfields or vehicle convoys, are typically located on the open areas of alluvial plains where it is not difficult to establish access to targets for maintenance. The avenues of aerial attack available to aircrews, however, are often delineated by intervening mountains and defended by simulated anti-aircraft missile and artillery

positions. There are many iterations of this basic target setting throughout the range—each with a different set of tactical circumstances created by the disposition of simulated enemy facilities, equipment, and forces within the terrain. Aircrews must learn to quickly recognize, understand, and solve the tactical challenges presented by each of these target settings. Because of the diverse use of terrain in target development, aircrews find each training sortie to be fresh and instructional rather than repetitious. The cumulative experience aircrews gain by facing the tactical diversity of the BMGR is essential for preparing them for combat.

4.2.2.2 Continued Segregation

The withdrawal of the BMGR for military purposes restricts the development of (1) potential mineral and energy resources that are known to occur or potentially occur within the BMGR and (2) other forms of appropriative land use (such as mining, geothermal leasing, or livestock grazing) for the duration of the renewal, which unless extended will expire in November 2024. However, potential future development of mineral and energy resources or other appropriative land use potentials following a future expiration of the range withdrawal are not precluded by the withdrawal.

The withdrawal and reservation of the range have excluded public land uses such as mining, livestock grazing, and agriculture, and has restricted intensive recreation for the past 60 years. These exclusions and restrictions on land uses that greatly modify natural landscapes have had the initially unplanned effect of protecting BMGR resources.

4.2.2.3 Existing Military Surface Disturbance

Some military mission activities require direct use and physical disturbance of select areas of the BMGR, such as designated target impact areas, in order to support the military mission. A detailed study of the types of military surface use and the level of physical disturbance (from negligible to complete disturbance) was conducted for and documented in the LEIS for the Renewal of the BMGR Land Withdrawal (U.S. Air Force 1999). The findings from this study have been updated but show that active and inactive military surface uses have collectively affected about 15.8 percent, or nearly 274,000 acres of the BMGR surface (Table 4-5). Included within these direct surface use acres are locations used or formerly used as munitions and target debris fall out for air-to-air gunnery, target layouts or simulations (such as bull's-eye targets or simulated airfields), air-to-ground munitions impact areas, EOD sweep areas, auxiliary airfields, maintenance and clean-up areas, ground support training areas, developed training sites (such as the Marine Corps rifle and pistol range west of AUX-2), and retired target or test areas. The levels of physical disturbance caused by these uses to soil surfaces and vegetation varies from negligible to complete disruption.

Of the 273,784 military surface use acres listed in Table 4-5, 212,755 acres are identified as currently supporting active military missions. Another 61,029 acres formerly provided military surface use areas. Of the 12.3 percent of the BMGR that continues to directly support military

TABLE 4-5
ACTIVE AND INACTIVE MILITARY SURFACE USE FOOTPRINT WITHIN THE BMGR

Line	Military Surface Use Area (Acres Included)	Associated Surface Disturbance	Total Acres	Percentage of BMGR Affected*
1	Primary air-to-air gunnery range (101,040)	Use causes or has caused negligible levels of disturbance to soil surface or vegetation community across affected area	101,040	5.8
2	Manned range active (1 km) five-year EOD clearance areas (19,070)	Use causes or has caused low to moderate levels of disturbance to soil surface or vegetation community across affected area	119,786	6.9
3	Tactical range active (1 km) five-year EOD clearance area (42,028)			
4	Additional retired manned range (1 nm) five-year EOD clearance areas (8,168)			
5	Additional retired tactical range (1 nm) five-year EOD clearance areas (50,520)			
6	Manned range annual EOD clearance area (7,615)	Use causes or has caused low to high levels of disturbance to soil surface or vegetation community across affected area	47,367**	2.7
7	HE hill dispersed munitions blast area (2,976)			
8	Tactical range inert target munitions impact area (17,154)			
9	Tactical range annual EOD clearance area (26,447)			
10	AUX-6 (334)			
11	Stoval Auxiliary Airfield (334)			
12	AUX-2 (215)			
13	Five closed auxiliary airfields (1,500)			
14	Ground troop deployment support areas (10,922)			
15	Gila Bend AFAF (2,007)	Use causes moderate to high levels of disturbance to soil surface or vegetation community across affected area	2,750	0.16
16	Manned range 50-use day EOD clearance area (308)			
17	Range maintenance, cleanup, and EOD support areas (435)			
18	Manned range cleared layout and targets (939)	Use causes or has caused high to complete levels of disturbance to soil surface or vegetation community across affected area	2,841	0.16
19	Tactical range cleared-target simulations (430)			
20	HE hill target core munitions blast areas (51)			
21	Developed training sites (180)			
22	Moving Sands/Cactus West cleared target areas (400)			
23	Retired test areas (841)			
24	**Total Active and Inactive Military Surface Use Acres (Sum of lines 1-6 and 9-23)**		**273,784**	**15.8**
25	**Total Active Military Surface Use Acres (Sum of lines 1-3, 6, 9-12, and 14-22)**		**212,755**	**12.3**
26	**Total Inactive Military Surface Use Acres (Sum of lines 4, 5, 13, and 23)**		**61,029**	**3.5**

* Percentages for each line are calculated as line area divided by 1,733,921 acres, the new area of the BMGR following the MLWA of 1999. Total percentages are rounded to the nearest 0.1 percent.

** This total does not include the acreages within the HE Hill dispersed munitions blast area (Line 7) or the tactical range inert target munitions impact areas (Line 8) because these areas lie almost entirely within the tactical range annual EOD sweep area (line 9).

activities, about 101,000 direct use acres (or 5.8 percent of the range) serve as the potential receiving area for aerial gunnery training munitions and targets from the active air-to-air firing range (see Table 4-5, line 1). The physical disturbance from munitions and target debris that falls to the ground in this receiving area is cumulatively negligible.

The remaining active cumulative military surface use area is 111,715 acres (see Table 4-5, sum of lines 2, 3, 6, 9-12, and 14-22) or about 6.4 percent of the total BMGR area. About 62 percent, or 68,956 acres (see Table 4-5, sum of lines 3, 9, 19, and 20), of this active use area is located within the three tactical ranges. An additional 25 percent of this active surface use, or 27,932 acres (see Table 4-5, sum of lines 2, 6, 16, and 18), is associated with the layout and use of the four manned ranges and almost 10 percent of this use, or 10,922 acres (see Table 4-5, line 14), is associated with the designated Marine Corps ground support areas. The remaining 3,905 acres (see Table 4-5, sum of lines 10, 11, 12, 15, 17, 21, and 22), or 3.5 percent of the active use area, are scattered about the range in the form of auxiliary airfields, including Gila Bend AFAF, developed training sites, maintenance and cleanup support areas, and the Moving Sands/Cactus West target complexes.

Slightly more than 3 percent of the total range surface supports active military surface uses that cause low to high levels of disturbance or result in a complete disruption of the original soil surface in core use areas or at developed use sites (see Table 4-5, lines 6, 9-12, and 14-22). Physical surface disturbance within a major portion of this acreage away from the core use and development areas was rated at only a low to moderate level.

Former military use areas identified to date affect about 3.5 percent of the BMGR surface (see Table 4.5, line 26). Most of this inactive use area (58,688 acres or 96 percent of the total inactive use area) is located in retired one-nautical-mile five-year EOD clearance areas that are outside of the current one-kilometer, five-year clearance areas within tactical and manned ranges (see Table 4-5, lines 4 and 5).

Nearly all of the active and inactive military surface use areas are located within the broad alluvial valleys of the BMGR (see Figures 3-1 and 3-2). The soils within these areas characteristically belong to the Torrifluvents Association; Tremant-Coolidge-Mohall Association; or Superstition-Rositas Association. These associations all have either moderate water erosion hazard potential or moderate to severe wind erosion hazard potential.

A few ground support areas in BMGR—West and some developed target areas, core impact, and some EOD clearance areas in BMGR—East have been so repeatedly and heavily used that the soils in these areas have been pulverized and have formed what is referred to as “moondust.” This has occurred in areas where soils are highly erodible and have experienced some erosion effects. The extent of such effects, however, are localized due to the low levels of annual rainfall and negligible slope of the alluvial plains in which most military use areas are located.

Accelerated erosion has occurred in association with some military use roads on the range. This localized phenomenon occurs most often in locations where road beds divert water from natural drainages of low slope within alluvial plains or where roads run parallel to steep slopes in upper bajadas and mountain foothill areas or at major wash crossings. Almost all roads on the BMGR were developed without engineering support including consideration of drainage patterns or erosion potentials. Nearly all roads have at-grade drainage crossings and are prone to flooding in response to rain. Infrequent rainfall and the fact that most roads traverse areas of little slope, however, has minimized road-induced erosion on the range.

The overall physical effects of current military activities on BMGR soils are limited principally to existing surface use areas. Some of these effects are locally severe, but off-site impacts from erosion in military use areas are minimal. Current military operations are restricted to locations of previous use.

4.2.2.4 Unexploded Ordnance Contamination

There is a potential for the presence of undetected ordnance containing live explosives either on or below the BMGR ground surface. Although nearly all locations within the BMGR would have to be regarded as suspect for contamination with hazardous munitions, the relative potential for munitions contamination within various range areas can be approximated according to the historic patterns of munitions use. The BMGR areas with the greatest potential for contamination with expended ordnance are North, South, and East TAC and the vicinities of Manned Ranges 1, 2, 3, and 4. A recent survey of inactive target sites within BMGR—East identified 18 such locations in and near these ranges (U.S. Air Force 2000b). The Moving Sands/Cactus West target complexes, formerly used targets such as Rakish Litter and Panel Stager, and the air-to-air firing range also have a high potential for being contaminated with expended ordnance.

Delivery of live ordnance may potentially contaminate soil as hazardous constituents are present in the munitions routinely used on the BMGR. These constituents are essentially consumed when munitions are fired and/or detonated on the range. Many of the munitions that malfunction and fail to fire and/or detonate are subsequently eliminated from the range during EOD clearances. The eventual fate of the chemical constituents of malfunctioning munitions that are not located during EOD clearances is undetermined. Also undetermined is the extent to which chemical by-products produced by the firing and/or detonation of munitions are present on the range. However, the findings of previous investigations suggest that contamination from these byproducts is unlikely (U.S. Army Corps of Engineers 1995, U.S. Air Force 1996, U.S. Air Force 1997a). Numerous soil samples have been collected from areas of the BMGR exposed to munitions residue. These soil samples were collected at sites where munitions scrap was buried per historical range clearance practices. The munitions residue was similar in type and concentration to the munitions currently consolidated at the RMCPs. Thus, the analytical results should be representative of areas where soils are exposed to the greatest concentrations of

munitions residues, such as the soils at the RMCPs where munitions scrap is stockpiled. These soil samples were analyzed for the presence of volatile and semi-volatile organic compounds, organochlorine insecticides, polychlorinated biphenyls (PCBs), priority pollutant metals, and total recoverable petroleum hydrocarbons. Only concentrations of arsenic and beryllium were found to exceed EPA Region IX residential preliminary remediation goals[31] of 0.32 milligram/kilogram (mg/kg) and 0.14 mg/kg, respectively, in both the sample and background concentrations. Arsenic and beryllium concentrations in tested soils exceeded background concentrations by factors of 4.0 and 1.5, respectively, which may be within the background range (U.S. Army Corps of Engineers 1995).

4.2.2.5 Foreseeable Future Military Surface Disturbance

The Marine Corps has approved an expansion of its surface use authority from 19.6 square miles up to 34.5 square miles within BMGR—West (addressed in the YTRC EIS, U.S. Marine Corps 1997). The approximately 9,500 acres approved for use, or 0.55 percent of the range surface, would be used principally for various ground troop deployment areas (see ground support areas and zones on Figure 2-2). Full use of the approved area would subject the area to the low to high disturbance effects of troop and equipment deployments. If used, the effects of deployments would not likely be uniformly distributed over the approximately 9,500 acres. Rather, troops and their equipment would tend to be concentrated within subsections of the approved use areas as is the current practice. The training practices of the Marine Corps have changed in the last few years, however, and little potential is foreseen that these new zones would be used to any large extent.

Other foreseeable future military uses that could affect earth resources include the following:

- The Air Force may excavate sand and gravel from dry washes in the vicinity of the BMGR tactical and manned ranges for use in road repairs and the reconditioning of the manned range strafe pits

- The Air Force may implement various actions to enhance BMGR—East targets. Actions being considered include siting and developing a Sensor Training Area for precision-guided munitions training without the use of live munitions, and the siting and installation of unmanned threat emitters

- The Air Force may clean up munitions and target debris from the surface of 18 inactive target sites for both safety and environmental management purposes. The cleanup operations would occur within a cumulative area of about 11,000 acres in the vicinities

[31] Preliminary remediation goals are EPA-published soil concentrations that represent chemical concentrations corresponding to a human health risk of one in one million, or less, in an unrestricted land use scenario.

of these target sites. Extensive surface disturbances are not anticipated if one-time EOD clearances of these sites are implemented

Prior to implementation, each of these aforementioned uses would be subject to review (including opportunity for public input) under the NEPA environmental impact analysis process. The potential cumulative effects of these and other actions in combination with the actions proposed in this EIS are evaluated in detail in Chapter 6.

4.2.3 Existing Statutory and Regulatory Requirements and Management Plans and Actions

4.2.3.1 Statutory and Regulatory Requirements

All agencies with administrative or management responsibility for the BMGR are required to comply with applicable federal laws, and to the extent sovereign immunity has been waived, federal agencies are also required to comply with applicable state and local laws, including those related to earth resources. Although there is a host of laws governing geologic exploration and development, none of these directly apply because the BMGR is withdrawn from such use. Many of the regulatory requirements protective of soil resources are related to proper management of solid and hazardous wastes and water runoff from developed areas and will thus be discussed in the corresponding sections of this document. The remaining identified regulatory requirements are summarized as follows:

- **MLWA of 1999 (P.L. 106-65).** As described in more detail in other sections of this document, the MLWA of 1999 excludes all mineral entry from the BMGR as similar withdrawal legislation has done since 1941. Section 3036 of the MLWA of 1999, notwithstanding the provisions of the Materials Act of 1947, authorizes military use of sand, gravel, or similar mineral material resources on the BMGR if use of such resources is required for construction needs on the BMGR.

- **Materials Act of 1947** (**30 U.S.C. 601** ***et seq***.). Allows for the Secretary of the Interior to dispose of mineral and vegetative materials on public lands if the disposal of such mineral or vegetative materials (1) is not otherwise expressly authorized by law, (2) is not expressly prohibited by laws of the United States, and (3) would not be detrimental to the public interest. Requirements for obtaining consent prior to disposal are specified.

- **Soil Conservation and Domestic Allotment Act (P.L. 74-461, 16 U.S.C. 590a** ***et seq*****.).** Sets forth the authorities of the Secretary of Agriculture for soil surveys and investigations, preventive measures, cooperation with agencies and persons, and acquisition of land.

- **Soil and Water Resources Conservation Act of 1977 (P.L. 95-192, 16 U.S.C. 2001-2009).** Further defines the authorities and responsibilities of the Secretary of Agriculture to include (1) appraising on a continuing basis the soil, water, and related resources of the nation; (2) developing and updating periodically a program for furthering the conservation, protection, and enhancement of the soil, water, and related resources of the nation consistent with the roles and program responsibilities of other federal agencies and state and local governments; and (3) providing this information to Congress and the public.

- **Federal Cave Resources Protection Act of 1988 (P.L. 100-691, 16 U.S.C. 4301-4310).** Requires the Secretaries of Agriculture or the Interior to (1) secure, protect, and preserve significant caves on federal lands for the perpetual use, enjoyment, and benefit of all people; and (2) foster increased cooperation and exchange of information between governmental authorities and those who utilize caves located on federal lands for scientific, education, or recreational purposes.

- **BLM Supplementary Rules for Recreation Mineral Collection (Federal Register Volume 63, Number One, dated 2 January 1998 [AZ-930-03-1220-00: 8365]).** Sets forth BLM policy for the collection of rocks, mineral specimens, common invertebrate fossils, semi-precious gemstones, and petrified wood on public lands administered by the Arizona BLM without charge or permit. The limit on collection of such specimens for personal use is 25 pounds per day, plus one piece, with a total limit of 250 pounds per year. Conditions under which the specimens may be collected include the restriction of motorized mechanical devices and where no undue or unnecessary degradation of the public lands occurs during the removal of rock, minerals, or gemstones. Other special rules apply for pieces of petrified wood heavier than 250 pounds.

- **DoD Instruction 4715.3, *Environmental Conservation Program.*** DoD policy is to manage lands to control and prevent soil erosion and to preserve natural resources by conducting surveys and implementing soil conservation measures. Altered or degraded landscapes and associated habitats are to be restored and rehabilitated whenever practicable.

- **Arizona State Mining Code.** The Arizona State Mining Code (Arizona Revised Statutes [ARS], Title 27, Section 27-318, Article A) states that failure to cover, fence, fill or otherwise secure and post warning signs at an inactive mining shaft, portal, pit, or other excavation that is dangerous to persons legally on the premises is a class 2 misdemeanor. The State Mine Inspectors Office is responsible for administering the provisions of the Surface Mining Control and Reclamation Act (30 U.S.C. 1231-1243) and is responsible for improving safety conditions in and around active and abandoned mining operations.

4.2.3.2 Lower Gila South RMP (Goldwater Amendment)

The Lower Gila South RMP (Goldwater Amendment) includes the following five management actions for earth resources:

1. Restrict the operation of motorized vehicles and heavy equipment to established roadways and previously impacted areas, except when the use relates to a specific permitted project.

2. Assess, as part of site appraisals for the NEPA evaluation process (that must precede initiation of new land-based activities), the vulnerability of soils to disruption and subsequent wind and water erosion.

3. Update the soils map database with new information collected during site evaluations.

4. Use the following techniques to minimize soil disturbance and conserve soil resources on previously unimpacted sites:
   - gain access to the site, where possible, by using existing roads and trails
   - use equipment, where possible, that creates the least amount of soil disturbance
   - return the disturbed areas to as close to predisturbed conditions as possible
   - minimize activities where it is known that soils are unstable and subject to wind erosion

5. In accordance with the BLM special recreation use policy, surface rock removal on the BMGR is limited for personal use to 25 pounds per day, plus one piece, with a total limit of 250 pounds per year.

4.2.4 Information Not Currently Available to Support Earth Resource Management

The current lack of some management data or information poses potential challenges for the future management of earth resources within the BMGR. This currently unavailable information was identified during the preparation of the affected environment section of this EIS. It does not constitute incomplete or unavailable information needed to conduct the environmental impact analysis presented in Chapter 5 in accordance with 40 CFR §1502.22. Although additional earth resources information needs may be defined in the future, those identified in this document include:

- *Soil Series Data.* Detailed survey data on the types and locations of soil series present on the BMGR are not available. Soil series information provides the level of detail on the chemical and physical properties of soils typically used for interpreting the suitability of a soil to support various potential land uses.

- *Soil Surface Disturbance from Non-military Land Uses.* A detailed evaluation of military surface uses and associated levels of soil surface disturbance was completed for the LEIS; however, no such data have been compiled to define the extent of surface disturbance resulting from non-military use including recreation activities, U.S. Border Patrol operations, and UDA traffic.

- *Recreational Rockhounding.* Non-commercial rockhounding (mineral, gemstone, and rock collecting) is a documented recreation activity on the BMGR. However, there are no data available on the extent or location of collectable rocks, minerals, and gemstones on the BMGR; current levels of rockhounding activity; or existing or potential adverse impacts of such activities to earth resources.

- *Geomorphic and Subsidence Mapping.* Subsidence has been observed in the Growler Wash area within South TAC, but no subsidence mapping of the BMGR is available. Geomorphic mapping is also lacking and, if it were available, may be used in selecting locations for future targets.

4.3 WATER RESOURCES

Because the BMGR is located in one of the most arid regions of North America, water is a scarce resource and important commodity to the biological resources and humans that rely on it. With the exception of one small, perennial spring, surface waters are typically present on the BMGR only after rains fill washes, playas, or natural or human-made catchments. Most surface water catchments on the BMGR were formed by natural geologic processes prior to the time prehistoric humans first entered the range and provided important water sources to early inhabitants. Over the past few decades, AGFD and others have modified many of the natural surface water catchments to retain ephemeral runoff for wildlife. Proper management of these catchments is important for the aquatic environments they support, the wildlife that rely on them, and (for some naturally occurring surface waters) their cultural significance. Other modifications to surface waters from impediments to flow and diversions—such as entrenched roads and washes, dams, and charcos—can affect rates of erosion and the distribution of nutrients from the upper to the lower watershed at rates to which natural community components are adapted (Marshall and others 2000).

The shallow groundwater resources of the BMGR have also played an important role as wells mark locations where these resources have been tapped to provide water for wildlife, past ranching and mining activities, and—most recently—military uses. Groundwater serves an important role in the establishment of some natural vegetative communities. The lack of perennial surface flows on the BMGR equates with a lack of aquatic/riparian communities that depend on such surface waters. However, xeroriparian systems exist where groundwater has been forced near the surface, such as may occur when washes travel within narrow gaps between mountain ranges (Marshall and others 2000). Although the communities neighboring the BMGR

rely on groundwater resources for some agricultural, domestic, and other purposes, BMGR groundwater resources are of poor quality due to high concentrations of total dissolved solids, boron, and fluoride (ADWR 1997, ARCADIS Geraghty & Miller 1998b). The Air Force and Marine Corps use water from BMGR wells for construction, dust control, and water supply for selected facilities.

4.3.1 Existing Conditions

4.3.1.1 Ecoregional Context

The BMGR lies within the central portion of the Sonoran Desert in the Basin and Range Lowlands Hydrogeologic Province. The area is characterized by high summer temperatures, moderate winter temperatures, and low rainfall and relative humidity (ARCADIS Geraghty & Miller 1998c). The Sonoran Desert is the hottest of the North American deserts, but has a distinctly bimodal rainfall pattern (winter and summer). The quantity of water and its temporal and spatial distribution are key factors that affect the characteristics of natural communities in the Sonoran Desert. Those natural communities most associated with water resources, such as riparian and xeroriparian areas, comprise a small percentage of the land area in Arizona, yet harbor the greatest diversity of plants and animals of any habitat type (Philips and Comus 2000).

Almost all of the natural surface water in Arizona has been developed. The principal natural surface waters in the vicinity of the range, the Gila and Colorado rivers, lie north of and west of the BMGR, respectively. Within the nearby portion of the lower Gila River, flow was historically perennial or seasonally intermittent. Following the construction of upstream dams, including the Gillespie, Coolidge, and Painted Rock, flow is ephemeral in response to precipitation events or water releases from these dams. The nearby portion of the Colorado River is perennial to seasonally intermittent as it flows south for approximately 200 miles from Parker Dam and encounters the Imperial, Laguna, and Morelos dams near Yuma before leaving the United States. In the vicinity of the BMGR, the water flow from both rivers is impounded and diverted to irrigate agricultural areas in the region and for municipal and industrial uses. In addition, a system of reservoirs on the Colorado River harnesses and supplies water for use by Arizona, California, Nevada, New Mexico, Utah, Colorado, Wyoming, and Mexico (Arizona Department of Water Resources [ADWR] 2001). Similarly, streamflow in the Rio Sonoyta, located to the south of the BMGR in Mexico, has been converted from perennial to intermittent due to groundwater pumping to serve agricultural, urban, and industrial purposes.

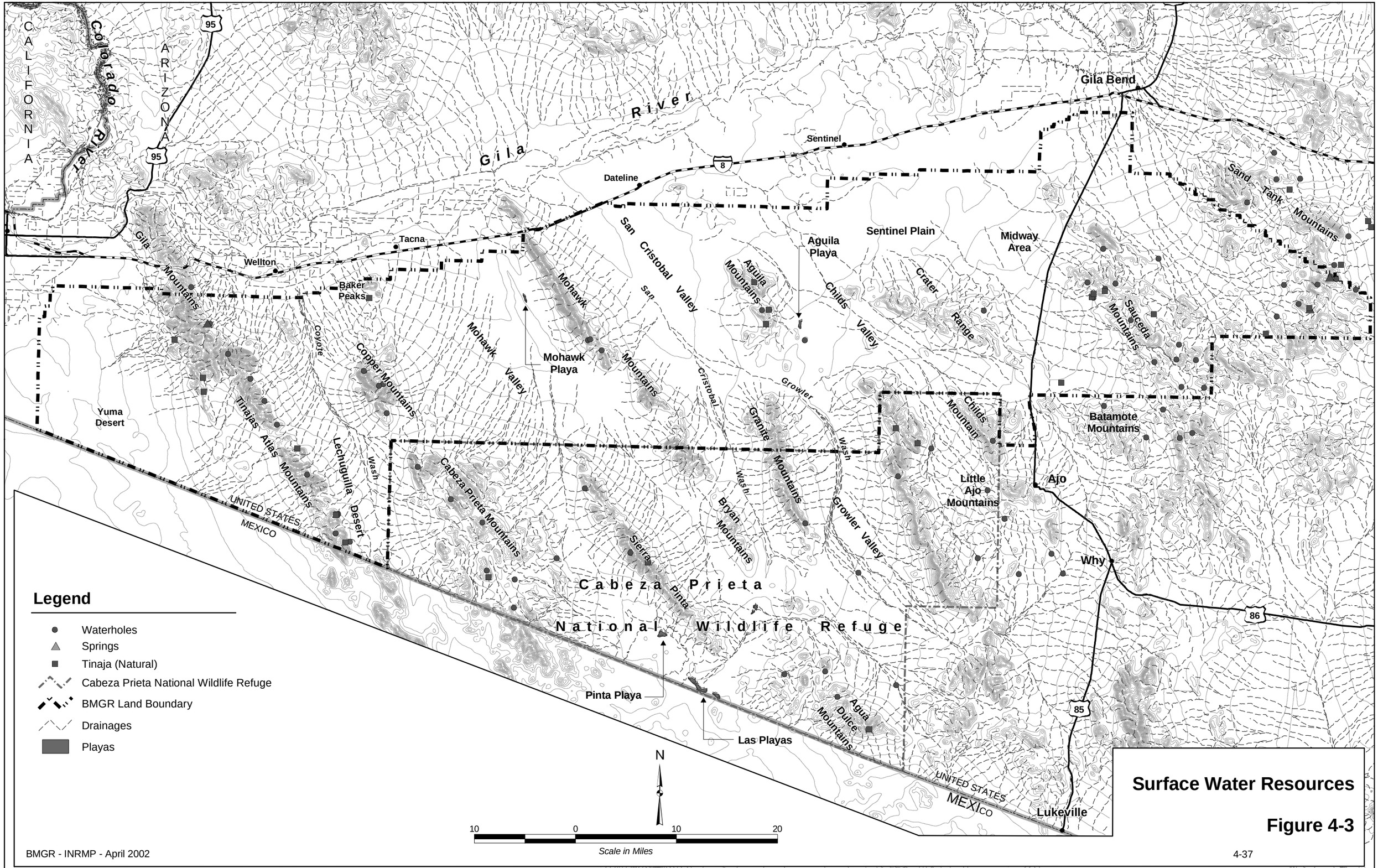
Groundwater depletion is another serious concern in the Sonoran Desert as groundwater has historically been pumped out more rapidly than it is being replenished, creating a condition called overdraft. About 40 percent of Arizona's water use comes from groundwater sources. Although a large amount of water remains stored in Arizona's aquifers, its availability is limited by location, depth, and quality. The 1980 Arizona Groundwater Management Act and Code

mandates that "safe yield" (when discharge does not exceed recharge) be established by the year 2025 in four active management areas where 80 percent of Arizona's population resides to promote water conservation and long-range planning of Arizona's water resources (ADWR 2001).

4.3.1.2 Surface Water Resources

The presence of surface water on the BMGR is very limited and typically dependent on the season and recent precipitation events. There are no perennial or intermittent streams present on the range. Rainfall is generally less than 5 inches per year within the BMGR. Yuma averages less than 3 inches of rain per year, Gila Bend averages between 5 and 6 inches of rain per year, and Ajo averages approximately 9 inches of rain per year (Sellers and Hill 1974). Some of the interior valleys within the range average only 0.5 inch of rain per year (ARCADIS Geraghty & Miller 1998b). Most of the annual precipitation occurs in mid-winter and in the late summer, often as intense rainfall. Evaporation potential exceeds precipitation, with annual evaporation rates ranging from greater than 86 inches along the Colorado River to about 72 inches along the eastern part of the range (Montgomery and Harshbarger 1989). In addition to being meager, desert precipitation is also highly variable and unpredictable. The average annual rainfall is a poor predictor of the rainfall in a given year. For example, although the average annual rainfall in Yuma, Arizona is around 3 inches, most years it receives less and sometimes none at all. When the stable weather pattern that enforces aridity breaks down occasionally, Yuma may receive two to three times its annual rainfall, sometimes in one storm (Phillips and Comus 2000).

Surface water drainage on the BMGR is outward from the mountain ranges and, for most of the area, ultimately northward by numerous intermittent washes into larger washes that flow to the Gila River, which in turn flows into the Colorado River (Figure 4-3). These drainages flow in response to the brief but intense summer monsoonal rainstorms or the longer duration rainfall events typical of the winter and spring. Some storms cause flash flooding in the smaller mountain drainages and short-term flooding in the larger valley washes and floodplains. Natural flooding events are highly variable in frequency and intensity and can have a large effect on natural community composition, structure, and function. The natural periodicity and intensity of flood events may be strongly influenced by the condition of the watershed (i.e., the amount of cover, the degree of human-caused alterations in drainage patterns, etc.) (Hall and others 2001).
That portion of the Lower Gila River and Colorado River watersheds within the BMGR are considered to function within a normal range of variation, although some small-scale alterations such as at the Midway and Tenmile washes-State Route 85 crossings may affect flooding patterns in localized areas. However, in shared portions of these watersheds outside the BMGR, large-scale alterations such as the damming and conversion of floodplains to agriculture and other developed land uses have affected the condition of these watersheds. Some of the surface water drainage, primarily in the southern portion of BMGR—West, is southward by numerous intermittent drainages into Mexico (see Figure 4-3). A few closed drainages on the range empty



Surface Water Resources

Figure 4-3

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into playas that hold water temporarily after substantial rains. Some water collects in surface water catchments, where it may be held for extended periods until totally evaporated or replenished by additional precipitation. Many of the drainage systems on the BMGR contain large expanses that are unregulated and lack impediments to flow and diversions. These drainage systems are recognized in Marshall and others (2000) as the Valley Bottom Floodplain Complex Natural Community (see Figure 2-5). Hall and others (2001) asserts that the BMGR contains some of the best remaining examples of this natural community and associated watersheds in Arizona and perhaps the entire Sonoran Desert.

Surface Water Catchments

Natural surface water catchments include rock depressions (referred to as "tinajas"), sand tanks (saturated sand depressions), playas (closed basin drainages), and/or springs and seeps. Tinajas and sand tanks typically form in stream channels (see Figure 4-3). Some of the larger tinajas, such as Tinajas Altas, may retain water year round and provide one of the most reliable sources of surface water on the BMGR. Playas within the BMGR are important to migratory birds and other wildlife. Mohawk Playa, located in BMGR—West, east of the Mohawk Dunes and Aguila Playa, located in BMGR—East, east of the Aguila Mountains are shown in Figure 4-3. Other smaller unnamed playas on the BMGR have not yet been mapped. Natural springs and seeps are usually dry most of the year. Two ephemeral springs, Bender and Burros springs, are located in the Sand Tank Mountains in the easternmost portion of BMGR—East (Hall and others 2001). Bender Spring is a fracture spring that is silted in, but supports cattails. Burros Spring is an intermittent spring where it is reported that burros have pawed to reach perched groundwater (Broyles and others 1997). Dripping Spring, which is located within the BMGR—West on the east side of the Gila Mountains (ARCADIS Geraghty & Miller 1998c), includes two seeps that are perennial during most years, two intermittent seeps, and tinajas (Broyles and others 1997).

Over the past few decades, AGFD has modified many of the natural surface water catchments on the BMGR and has built many artificial catchments to retain ephemeral runoff for wildlife. A detailed discussion of the 42 actively managed artificial or enhanced natural catchments on the BMGR is provided in Section 4.6.3, under the subheading "Wildlife Water Developments."

4.3.1.3 Watersheds and Major Drainages

The BMGR is located primarily within the Lower Gila River Watershed, with a portion of BMGR—West located within the Colorado River Watershed. The entire Gila Watershed drains approximately 57,900 square miles of the southwestern United States and joins with the Colorado River Watershed near Yuma (ADWR 2001). In the Colorado River Watershed area of BMGR—West, the central drainage is Coyote Wash (Figure 4-3), which is more than a mile

wide in some areas (USGS 1977). Coyote Wash drains the broad alluvial Lechuguilla Desert Valley between the Gila and Tinajas Altas mountain chain and Copper and Cabeza Prieta mountains north to the Gila River. Another distinct wash system is Mohawk Wash, which begins between the Cabeza Prieta Mountains and the Sierra Pintas in the Cabeza Prieta NWR and extends northward where it dissipates into multiple, indistinct small channels due to the low northward gradient (USGS 1982). The Mohawk Wash reforms further to the north and east of Tacna before emptying into the Gila River. Further to the west, alluvial fans have developed outward from the Gila and Tinajas Altas mountains. Washes have developed to drain these fans and the upland mountain areas further east. The most predominant of these is the Fortuna Wash, which drains northward to the Gila River (USGS 1977). Other less developed washes drain from the Yuma Desert to the west to the Colorado River or southwest to the Gulf of California.

Within the Lower Gila River Watershed portion of BMGR—East, the most extensive wash system is the San Cristobal Wash (see Figure 4-3). The San Cristobal Wash lies east of the Mohawk Mountains to the Aguila and Granite mountains, runs from south to north, and empties into the Gila River. A major tributary to this wash is the Growler Wash (see Figure 4-3), which drains the Growler Valley to the east of the Granite Mountains. The San Cristobal Wash, as it occurs within the BMGR, is of significance because the very low gradient along much of its course has led to the development of a broad interlacing network of many small, branching and reuniting shallow channels, resembling in plan view the strands of a complex braid. Water movement by sheet wash rather than by deep channel flow is dominant in many locations along this system although an area of broad gully cutting is occurring where the Growler Wash bends to the northwest at its confluence with Daniels Arroyo.

Tenmile Wash in Childs Valley and Midway Wash in the Gila Bend Plain are similar, less complex wash systems. These two drainage basins are separated by the Crater Range and drain large, relatively flat alluvial areas northwest toward the Gila River. Midway Wash carries drainage from south and west of the Sauceda Mountains. In Sauceda Valley, the Quilotosa and Sauceda washes drain the Sauceda and Sand Tank mountains upland areas northwest toward the Gila River. The Quilotosa Wash principally drains the Sand Tank Mountains areas, while the Sauceda Wash principally drains the Sauceda Mountains area.

4.3.1.4 Wetlands, Floodplains, and Jurisdictional Waters of the United States

In an assessment conducted for the renewal of the BMGR land withdrawal, Geraghty & Miller (1997) used existing literature and maps as well as interviews with persons knowledgeable about BMGR resources to document the nature and distribution of wetlands and special aquatic sites (man-made and non-wetland features) on the BMGR and Cabeza Prieta NWR. A total of 206 special aquatic sites were identified. Of these sites, 19 may be considered wetlands due to their inclusion on USFWS National Wetland Inventory maps (Geraghty & Miller 1997). However,

more than half of these 19 potential wetland sites are located within the Cabeza Prieta NWR, which is no longer a part of the BMGR. While the extent of wetlands within the BMGR is not well defined, it is clear that very few wetland areas exist on the range, which is consistent with the limited amount of rainfall and general lack of surface water.

The Federal Emergency Management Agency (FEMA) provides 100-year floodplain and hazard boundary maps as part of the Flood Insurance Rate Map program. These maps indicate special flood hazard areas, base flood elevations, and flood insurance risk zones. Although there are flood hazards in the BMGR along the major washes, FEMA has not delineated 100-year floodplains on the BMGR. The 100-year flood hazard boundary occurs to the north of the BMGR, along the upslope side of the Gila Bend Canal, along portions of Interstate 8, and along portions of the Southern Pacific Railroad (FEMA 1988).

Some of the intermittent surface drainageways in the BMGR might be considered jurisdictional waters of the United States (Geraghty & Miller 1997) and possibly subject to the Clean Water Act. However, recent legal developments limiting Clean Water Act jurisdiction may change this legal dynamic. Activities in and around jurisdictional waters require adherence to the Clean Water Act and activities with the potential to impact these waters may require obtaining state water quality certification under Section 401 and/or federal permit under Section 402 and/or 404 of the Clean Water Act. The U.S. Army Corps of Engineers, EPA, and ADEQ (as authorized by the EPA) administer these permits.

4.3.1.5 Groundwater

The BMGR includes portions of two major groundwater basins within the ADWR Lower Colorado River Planning Area: the Yuma and Lower Gila Basins. Within both of these basins, groundwater occurs in both floodplain and basin fill deposits. Streambed or floodplain deposits (consisting of sand, gravel, cobbles, and boulders) range from about 10 feet thick in the smaller washes to as much as 110 feet thick in the Gila River floodplain. The basin fill deposits may be divided into three separate units: an upper sandy unit, a middle fine-grained unit, and a lower coarse-grained unit. These units vary in thickness and may not be present at all locations. Groundwater recharge on the BMGR is from infiltration of rainfall runoff and underflow from groundwater basins that are hydraulically upgradient (ADWR 2001).

Groundwater at the BMGR has been found to be of poor quality due to naturally occurring concentrations of inorganic compounds. Typically groundwater in the area has high concentrations of total dissolved solids, boron, and fluoride. Concentrations of arsenic may exceed drinking water standards in some areas. Depth to groundwater on the BMGR, based on very limited well data, varies from about 50 feet along major wash tributaries near the Gila River to nearly 600 feet in the Coyote Wash sub-basin east of the Tinajas Altas Mountains. Depth to

groundwater is typically on the order of several hundred feet below ground surface. Shallow groundwater has occasionally been noted, probably occurring in a zone of perched water (ADWR 1997, ARCADIS Geraghty & Miller 1998b).

Groundwater supplies in the Lower Gila Basin are primarily developed from wells completed in the basin fill deposits. Estimates of well yields for areas north of the BMGR and south of Interstate 8 range from 500 to 2,500 gallons per minute (gpm). Estimates of well yields on the BMGR range from 250 to 800 gpm. The military uses an estimated 70 million gallons of water per year from this basin, primarily for construction and dust control (Table 4-6) (ARCADIS Geraghty & Miller 1998b).

A total of 74 registered wells are identified on the BMGR in the ADWR Well Registry. Of these wells, 13 are registered to military agencies. Eight of the wells are registered to the U.S. Marine Corps and include production wells at the rifle range, tracker shed, and the Cannon Air Defense Complex along with monitoring wells at the Cannon Air Defense Complex. Five wells are registered to the U.S. Air Force including three at the Gila Bend AFAF and two wells at North Tactical Range and the RMCP located between Range 1 and the North and South tactical ranges.

Additional well inventories compiled as part of the water resources assessment for the renewal of the BMGR land withdrawal (ARCADIS Geraghty & Miller 1998b) identified 96 wells (ADWR's Groundwater Site Inventory database) and 80 wells (Wetlands and Floodplains Overview Report [Geraghty & Miller 1997]) on the BMGR, including the Cabeza Prieta NWR and other parcels of land that were not renewed by the MLWA of 1999. Each of these inventories includes many of the same wells. Some of these wells may have been abandoned or are no longer in use.

Military agencies on the BMGR use water from wells for construction, dust control, and potable water supply for selected facilities (see Table 4-6). Two production wells currently supply the U.S. Air Force for needs at the Gila Bend AFAF and field activities at the Manned Ranges. The U.S. Marine Corps uses water at several facilities at the far west side of the BMGR, including the rifle range, tracker shed, and Cannon Air Defense Complex. Production wells at the rifle range and tracker shed provide water for construction, maintenance, and dust control. Cannon Air Defense Complex uses one production well for a potable water supply. Water for Marine Corps field exercises is either hauled from MCAS Yuma or is withdrawn from the Wellton-Mohawk Irrigation District canals along the northern part of the BMGR (ARCADIS Geraghty & Miller 1998b).

4.3.1.6 Factors Affecting Water Quality

Groundwater quality in the Gila Bend area is considered to be poor. Concentrations of total dissolved solids (TDS) in groundwater samples is reported to range from 937 to 4,940

TABLE 4-6
SUMMARY OF MILITARY WATER USES ON THE BMGR

Facility	Type of Use	Quantity of Water Used	Annual Quantity of Water Used	Future Annual Water Demand	Storage Capacity	Water Source	Construction	Pump Type/Capacity	Depth to Water (feet)*	Conductivity (uS)*	pH*	Temperature (C)*
Gila Bend AFAF	Delivery to two potable water systems; BMGR water deliveries	68.8 Mgal/year	68.8 Mgal	68.8 Mgal	100,000-gallon raw water storage tank; 36,000-gallon water storage tank for reverse osmosis treatment system; 36,000-gallon water tower for second delivery system	Well #3 (55-609892); pumps to raw water storage tank	16-inch diameter steel casing, total depth = 607 feet (from Gila Bend AFAF records)	Submersible 250 gpm	302	2,000	8.2	31.5
						Well #4 (55-609893); pumps to raw water storage tank	16-inch diameter steel casing, total depth = 603 feet (from Gila Bend AFAF records)	Submersible 750-800 gpm	297	2,000	8.4	33
						Well #2 (55-609891); capped, not in use	14-inch diameter steel casing, total depth = 646 feet (from ADWR well registry)	None	NM	NM	NM	NM
						Well #1; abandoned during construction of water tower	Unknown	NA	NA	NA	NA	NA
BMGR – Manned Ranges 1-4	Non-potable uses, latrines	4,500 gallons/ month	54,000 gallons	54,000 gallons	NA	Hauled from Gila Bend AFAF	NA	NA	NA	NA	NA	NA
Cannon Air Defense Complex	Delivery to potable water system	5,000 gallons/ day	1.8 Mgal	1.8 Mgal	125,000-gallon storage tank; 5,000-gallon pressure tank; small holding tank for new well	Old Well (55-607940); main water source, pumps to storage tank	8-inch diameter steel casing, total depth = 225 feet (from Marine Corps personnel)	Submersible	80	1,900	8.2	26
						New Well (55-514319); backup water source, pumps to small holding tank	6-inch diameter steel casing, total depth = 220 feet (from Marine Corps personnel)	Submersible	80	2,200	8.1	25.5
Tracker Shed	Non-potable uses, road construction, maintenance	Negligible	Negligible	Negligible	None	Unregistered Well	8-inch diameter steel casing (field measurement)	Submersible	NM	NM	NM	NM
Rifle Range	Non-potable uses, dust abatement, construction	Negligible	Negligible	Negligible	None	Well 55-561327	8-inch diameter steel casing, total depth = 400 feet (from ADWR well registry)	Submersible	116	1,260	9.7	31
Marine Corps Field Exercises	Potable water for field personnel	Unknown	Unknown	Unknown	NA	Hauled from MCAS Yuma or purified in the field from the Wellton Mohawk Irrigation District	NA	NA	NA	NA	NA	NA

Notes:
* = Measured during field verification on 24 March 1998
NA = Not Applicable
NM = Not Measured
gpm = gallons per minute
Mgal = million gallons
Source: ARCADIS Geraghty & Miller 1998b

milligrams per liter (mg/L), exceeding the EPA secondary maximum contaminant level for TDS of 500 mg/L. Secondary maximum contaminant levels are unenforceable federal guidelines regarding taste, odor, color, and certain other aesthetic characteristics of groundwater. Groundwater in the area also contains high concentrations of sodium and boron (NRCS 1997).

Military activities and factors that have the potential to affect the quality of surface water and groundwater on the BMGR include the following:

- Septic system leachfields, dry wells, and sewage treatment systems
- Discharge from reverse osmosis water treatment systems (no longer used)
- Grey water systems for field deployments
- Vehicle wash racks
- Shop drains
- Solvent storage and use
- Fuel storage and refueling at established facilities and at field sites
- Vehicle leaks and accidents
- Aircraft leaks, crash spills, or fuel tank jettison
- Exploded ordnance byproducts
- Unexploded ordnance
- Ordnance disposal operations

The potential for those military activities that occurred prior to the advent of modern environmental compliance requirements to have contaminated water resources were investigated in a Site Inspection Report prepared for the BMGR (U.S. Army Corps of Engineers 1995). All identified sites were investigated, remediated as required, and received authorization for site closure. No evidence of surface or water contamination was found in these investigations. Current military activities on the BMGR that require the use, transfer, or storage of hazardous materials or wastes are required to operate within the guidelines established in their respective spill prevention and countermeasures plans to prevent contamination. Any past practices that were handled under previously existing regulations but have presented current problems are characterized and remediated as appropriate. A discussion of the use, storage, and disposal of hazardous materials on the BMGR is given in Section 4.18.1.

In addition, wildcat dumping and the dumping of human waste at recreational campsites has the potential to affect water quality (see Section 4.18.1.2 for more detail). This potential has not historically been identified as a factor of concern for water quality in the BMGR, but such concerns were raised during public scoping for this EIS (see Table 1-5).

4.3.2 Interrelationship Between the Military Mission and Water Resources

The military mission does not depend on the presence of surface water at the BMGR, but a slight potential exists for the mission to adversely affect surface water. Military activities that

physically disturb the ground surface could increase the vulnerability of soils to erosion from storm water runoff and disrupt natural patterns of nutrient distribution. The storm water runoff could carry sediment to surface waters. Stormwater runoff from areas with soil contamination could adversely affect the quality of water in catchments or other surface waters.

However, with the exception of the Baker Tanks, the natural and constructed surface water catchments on the BMGR used by wildlife lie upstream of surface areas used for military activities. There is little potential that the quality of these waters is affected by military activities or that continuing military use would impact these waters. The Baker Tanks are downstream of some ground support areas used occasionally for troop deployment activities. Storm water runoff from these support areas could periodically reach the Baker Tanks. Runoff could carry some increase in suspended sediment load as a result of physical surface disturbance at the support areas but is unlikely to be contaminated by other substances.

Contamination of off-range surface waters as a result of existing or continuing military activities is also unlikely. Both the Air Force and Marine Corps conduct ongoing programs to prevent, contain, and clean-up spills of hazardous and toxic materials resulting from ground-based activities or military aircraft crashes on the BMGR. These programs minimize the potential that an inadvertent spill of such material generated by military activities could be transported off-range by infrequent surface runoff events to downstream perennial waters.

Residues from exploded ordnance or explosive propellants leaching from unexploded ordnance are another potential source of surface water contaminants. The extent to which these substances are present on the BMGR is not specifically known, but the highest relative concentrations of explosive residues and leachates would occur at the three HE Hill and two live Maverick Missile targets. The transport of these materials off range via storm-water runoff to downstream perennial waters would be hindered by the same factors that retard off-range suspended sediment transport from target areas. Thus, it is unlikely that explosives or explosives residues transported by surface runoff from BMGR target areas would cause notable contamination of perennial surface waters located off of the range.

The potential for groundwater contamination as a result of continuing military operations on the BMGR is also generally regarded as low. Ongoing Air Force and Marine Corps management practices for spill prevention, containment, and clean-up prevent significant quantities of hazardous or toxic materials used during ground-based activities from entering soils. An equally responsive ongoing program ensures the clean-up and removal of any contaminants, such as fuel or engine lubricants, that may be spilled as a result of an aircraft crash.

The extent to which explosives from unexploded ordnance or residues from ordnance detonations could contaminate groundwater on the range is not known. Explosive ordnance use is limited to the three HE Hill and two live Maverick Missile targets on the range. It is estimated that less than 10 percent of the live ordnance rounds delivered on the range fail to explode and

the unexploded rounds that remain on the surface are detonated in place during the annual EOD sweeps. The result is that the quantity of unexploded munitions that may accumulate each year within the designated live ordnance target areas is relatively small. While the number of buried unexploded munitions could accumulate over time, the bomb cases would have to be breached or corrode before the explosives could become potential groundwater contaminants. The fact that the cases of most rounds found on the surface appear to be intact indicates that delivery does not crack bomb cases very often. Bomb case corrosion would occur only very slowly because of the extreme dryness of the range.

The military mission depends on groundwater for construction, dust control, fire control, and for potable and non-potable water supply. Water supplies are obtained from wells on the BMGR and in some cases, imported from sources outside of the BMGR. Groundwater supplies are unlikely to be impacted by the military mission at the current levels of groundwater extraction. Records of annual measurements of non-pumping and pumping water level, pumping rates, quantities pumped, and groundwater quality should be maintained to evaluate well performance, and impacts to groundwater quality and quantity. If the military mission requires increased extraction of groundwater, additional testing of the aquifer in response to pumping may be required to evaluate the adequacy of the water supply and the impact of proposed additional groundwater extraction. Groundwater quality could be adversely impacted by spills or leaks of hazardous chemicals near the point of release or by infiltration of contaminated storm runoff.

4.3.3 Existing Statutory and Regulatory Requirements, Management Plans, and Water Use

This section provides an overview of the laws and regulations pertinent to water resource management on the BMGR, lists the management actions that are included in the current resource management plan (the BLM's Goldwater Amendment), and discusses the military's ongoing use of surface water and groundwater.

4.3.3.1 Statutory and Regulatory Requirements

Many of the statutory and regulatory requirements regarding water resources are related to preserving water quality or preserving features that exist as a result of long-term exposure to water. Key statutory and regulatory requirements that may be applicable to the BMGR are summarized below.

- **Clean Water Act of 1977 (with amendments) (33 U.S.C. 1251 et seq.).** This Act is the major federal legislation to restore and maintain the chemical, physical, and biological integrity of the nation's waters (including lakes, reservoirs, wetlands, and perennial and ephemeral watercourses). The Act provides for the development of municipal and

industrial wastewater treatment standards and a permitting system to control wastewater discharges to surface water. The Act contains specific provisions for the regulation of the disposal of dredged soil within navigable waters, and placement of materials into wetlands. Permits are required under Sections 401, 402, and 404 of the Act for proposed actions that involve wastewater discharges and/or dredging/placement of fill in wetlands or navigable waters. These permits are required prior to the initiation of proposed projects. Federal agency actions must also be consistent with state nonpoint source pollution management plans.

Activities requiring a 401 certification – Any actions that require a federal permit, license, or approval that results in a discharge into waters of the state. Section 404 dredge and fill permits and Section 402 permits are the most common actions requiring Clean Water Act Section 401 certification in Arizona (U.S. Army Corps of Engineers 1993).

Activities requiring a 402 permit – A National Pollutant Discharge Elimination System (NPDES) permit, or 402 permit, is required whenever there is a discharge of a pollutant from a point source (including outfalls from a pipe, such as discharges of treated wastewater) into dry washes, streams, or other waters of the United States. An NPDES general permit is required for storm water discharges from construction activities where five or more acres will be graded or disturbed (U.S. Army Corps of Engineers 1993). The purpose of the NPDES program for construction activities is to improve water quality by establishing a permit system to reduce erosion potential, minimize sedimentation, and eliminate non-stormwater discharges from construction sites. The Notice of Intent to begin construction that is submitted to the EPA must include documentation that a Storm Water Pollution Prevention Plan has been prepared. The Storm Water Pollution Prevention Plan identifies the practices that will be implemented to reduce storm water pollution and the persons responsible for implementing the plan.

Activities requiring a 404 permit – A 404 permit is generally required when actions result in a discharge of dredged or fill materials into waters of the United States, including wetlands.

- **Safe Drinking Water Act of 1974 (42 U.S.C. 300f et seq.).** This Act requires the EPA to establish a program that provides for the safety of the nation's drinking water. Regulations under this Act can be found in 40 CFR, Section 141 et seq.

- **Executive Order 12088, Federal Compliance with Pollution Control Standards (1978).** Requires the head of each executive agency to be responsible for ensuring that all necessary actions are taken for the prevention, control, and abatement of environmental pollution with respect to federal facilities and activities under the control of the agency.

- **Executive Order 11990, Protection of Wetlands (1977).** Requires federal agencies or federally funded projects to restrict uses of federal lands if use would threaten wetland values. Requires additional considerations to protect wetlands. The order was issued to "avoid to the extent possible the long and short-term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands whenever there is a practicable alternative." Federal agencies are required to provide for early public review of any plans or proposals for new construction in wetlands.

4.3.3.2 Lower Gila South RMP (Goldwater Amendment)

The Lower Gila South RMP (Goldwater Amendment) identifies the following management actions for water resources. Where applicable, enumerated management actions are followed by a statement of the status of implementation in italicized text.

1. Keep groundwater development and exploration to a minimum in ACECs, other management areas, and other environmentally sensitive areas.
   No groundwater development or exploration occurred on the BMGR since the publication of the Goldwater Amendment, until 2002 when a well was dug to support the Sonoran Pronghorn forage enhancement plots, which is a strategy being implemented based on the Sonoran pronghorn Recovery Plan.

2. Limit, to the greatest extent possible, all field activities relating to groundwater exploration and development to designated roadways and previously disturbed areas.
   As noted above, no groundwater development or exploration occurred on the BMGR until 2002.

3. Coordinate with the AGFD to be sure all wells within the BMGR are registered with the ADWR. Inventory all water sources and enter them into the BLM water data management system. Coordinate water rights filings for water sources with the U.S. Air Force and AGFD.
   As detailed in Section 4.3.1.6, some well inventory efforts occurred in association with the renewal of the BMGR land withdrawal.

4. Keep informed of new federal and state water laws that might allow outside groups access to BMGR groundwater.

5. Develop a systematic, readily available database containing all hydrologic, geologic, and geophysical studies conducted on the BMGR.
   Has not occurred.

6. Conduct a reconnaissance assessment of the groundwater resources in the Yuma Desert Basin, Lechuguilla Desert Basin, Mohawk Valley Basin, San Cristobal Valley Basin, Crater Range-Sauceda Valley Basin, and the Sauceda-Sand Tank Valley Basin.
   Has not occurred.

7. Monitor the water table levels to determine how perimeter water use may be affecting water reserves on the BMGR.
   Has not occurred.

4.3.3.3 Surface and Groundwater Use

Under Arizona law, appropriations of surface water and groundwater are decided separately. Groundwater appropriation is governed by the doctrine of reasonable use by which a landowner may pump as much groundwater as required for reasonable use on that property. Wells on the BMGR are subject to registration and installation rules as established by the ADWR. Surface water is governed by the doctrine of prior appropriation by which a person who first uses a surface water source has greater rights to those waters over subsequent users. There are some cases (such as wells adjacent to a stream) where groundwater wells may be drawing water from a surface water source. These wells are subject to surface water rights laws. The surface water rights in Arizona, including waters of the Gila River and its tributaries, are currently undergoing a judicial review as part of a general stream adjudication to determine the amount and priority of surface water rights and the final criteria in determining the difference between groundwater and surface water (ARCADIS Geraghty & Miller 1998b).

As part of the water resources assessment for the renewal of the BMGR land withdrawal, future water requirements on the BMGR were estimated based on current demands, except for the Gila Bend AFAF where future use was based on a demand projection model (ARCADIS Geraghty & Miller 1998b). Water rights claims have been filed under the Lower Gila River Adjudication for the Gila Bend AFAF production wells, other BMGR wells, and surface water sources on the BMGR so that these water uses will be included in the adjudication. The U.S. Air Force has filed for 127 Statement of Claimant forms in the Lower Gila Watershed of the ongoing Gila River System and Source General Water Rights Stream Adjudication for surface water and groundwater sources on the BMGR and Gila Bend AFAF, and for future water uses that may be necessary for military needs and for wildlife (ARCADIS Geraghty & Miller 1998b).

The Marine Corps wells are considered to be in the Colorado River watershed so they are not part of the Gila River General Stream Adjudication. There are unresolved water rights issues in the Yuma area regarding the potential diversion of Colorado River water through groundwater wells. The Bureau of Reclamation currently controls operation of the Colorado River and does not expect a decision on these water rights issues for several years. Because of the distance these

BMGR wells are from the Colorado River, it is unlikely they will be affected by the ruling (ARCADIS Geraghty & Miller 1998b).

Future military groundwater uses are estimated to be approximately 211 acre-feet per year (nearly 69 million gallons per year) (see Table 4-6). Current annual water usage at the Gila Bend AFAF is 68.8 million gallons, 0.05 million gallons at BMGR Manned Ranges 1 to 4, 1.8 million gallons at the Cannon Air Defense Training Complex, and very minor amounts at the tracker shed and rifle range. An additional 1,802 acre-feet of water may be required at Gila Bend AFAF and elsewhere on the BMGR to support potential future military uses. This is based on two adjudication claims submitted to ADWR by the Air Force, one for 1,628 acre-feet annually for the Gila Bend AFAF and the other for 174 acre-feet annually on the BMGR to support potential future military uses. All wells used for military purposes on the BMGR have been registered (except the tracker shed well which is in the process of being registered) with ADWR. Some of these existing well registrations and adjudication claims with ADWR for the wells being used by the Air Force and Marine Corps are being amended to provide a more complete and accurate data record. An additional well was dug in 2002 to provide a water source to support the Sonoran pronghorn enhancement plots.

4.3.4 Information Not Currently Available to Support Water Resource Management

The current lack of some existing data or information poses potential challenges for the future management of water resources within the BMGR. This currently unavailable information was identified during the preparation of the affected environment section of this EIS. It does not constitute incomplete or unavailable information needed to conduct the environmental impact analysis presented in Chapter 5 in accordance with 40 CFR §1502.22. Although additional water resources information needs may be defined in the future, those identified in this document include:

- *Surface Water Quality*. Consumption of water-borne toxins has been suggested as a potential explanation for desert sheep mortalities near waterholes, as well as sudden, unexplained sheep population dieoffs (deVos and Clarkson 1990, Broyles 1995). In its 1996 Biological Opinion on Air Force use of the BMGR for ground surface and airspace training, the USFWS has identified a concern that aluminum concentrations may be elevated in vegetation and soils as a result of munitions delivery operations in target areas and may pose a problem to Sonoran pronghorn. In response, the Air Force conducted a study that found that aluminum occurred in high concentrations in vegetation and soils, regardless of their proximity to HE hills or other targets within BMGR—East (Barry 2002c). However, specific information on the quality of surface waters, including aluminum concentrations, on the BMGR is not available. In 2001, water quality samples were collected from wildlife water developments north of the BMGR in Yuma Proving Ground, Kofa NWR, and adjacent BLM lands. The findings were that, in general, water

quality met recommended guidelines for domestic and wild animals with the exception of fluoride, which exceeded the suggested maximum on more than one occasion at ten sites, all of which used groundwater (Rosenstock and Rabe 2002).

- *Wetland Determinations.* Geraghty & Miller (1997) reports that some of the special aquatic sites on the BMGR may fit the Army Corps of Engineers or the Executive Order 11990 definitions of wetlands. This conclusion is reached because some of the special aquatic sites are included on available USFWS National Wetland Inventory maps. However, it is unclear as to whether there has been any field verification as to whether these sites qualify as wetlands.

- *Other Water Resource Information Needs*. TNC identified that the current understandings of the natural flow regime of the Valley Bottom Floodplain Complex, Valley Xeroriparian Scrub, and Mountain Xeroriparian Scrub natural communities and disruptions to those regimes and the hydrological dynamics of the Desert Playa and Desert Tinaja/Spring natural communities are inadequate. Particular emphasis is placed on the inventory and mapping of tinajas and playas and the potential effects of certain types of water catchments on downstream xeroriparian ecosystems (Hall and others 2001). The need for a comprehensive inventory of tinajas has been underscored by the recent identification of new tinajas in Management Unit 6 and their potential importance for natural and cultural resource management.

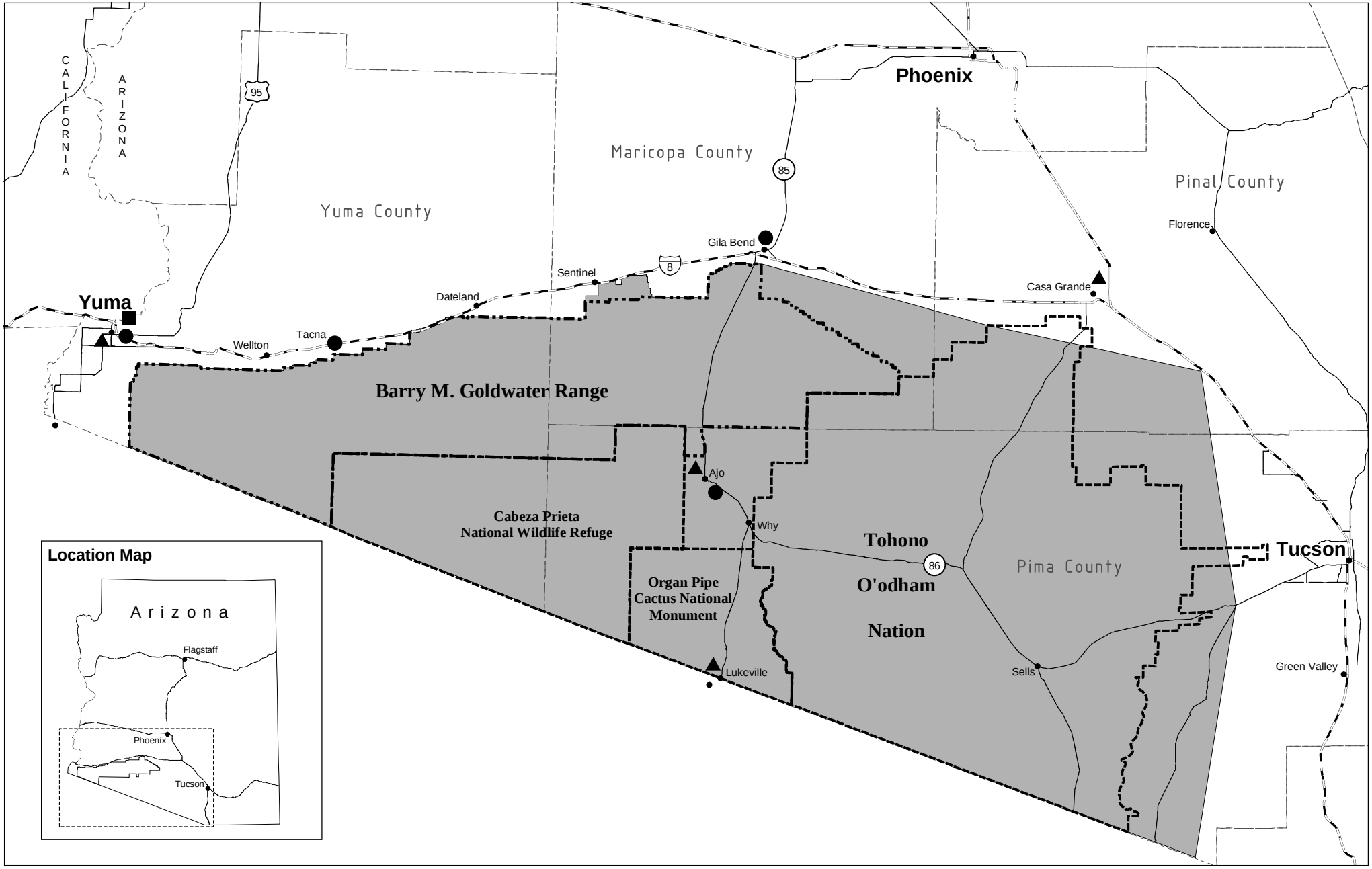
4.4 CLIMATE AND AIR RESOURCES

4.4.1 Existing Conditions

This section briefly describes the climatology, meteorology, and air quality of the BMGR study area for this EIS. Data from Yuma, Ajo, Organ Pipe Cactus NM, Gila Bend, Casa Grande, Tucson, and Phoenix have been used to the extent data are available, to characterize the existing conditions at the BMGR in the absence of information specific to the range. Figure 4-4 shows these locations, their proximity to the study area, and the data obtained from each location.

4.4.1.1 Climatology

The study area is a vast, arid region covering portions of Yuma, Maricopa, and Pima counties in southwestern Arizona. Elevations of the desert floor vary from near sea level to more than 2,000 feet MSL with some of the many mountain ranges that rise from the desert floor reaching heights of about 3,700 feet MSL.



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10 5 0 10 20

Scale in Miles

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Legend

- Air Quality
- Climatology
- Meteorology
- Air Quality Study Area

Locations of Air Quality Data Sources in the BMGR Region

Figure 4-4

Temperatures in the area range from the mid-30s degrees Fahrenheit (^{0}F) during the winter (average daily minimum) to over 100 ^{0}F during the summer (average daily maximum); diurnal temperature ranges of 30 ^{0}F or more are not uncommon. Maximum daily temperatures of 90 ^{0}F or higher occur during nearly 50 percent of the year and maximum temperatures may reach higher than 120 ^{0}F. Table 4-7 summarizes mean temperatures and precipitation amounts obtained at four locations adjacent to the study area.

Precipitation in the area is sparse and is limited primarily to rainfall, although traces of snow, sleet, or hail have been reported. Annual rainfall amounts generally decrease as one moves to the north and west from the Tucson area. For example, of the four locations presented in Table 4-7, Ajo and Gila Bend receive an average of approximately 8 and 6 inches of rainfall per year, respectively, with a large portion of this occurring during July through September. It is estimated that the highest elevations in the northeastern uplands of the BMGR (above 3,500 feet MSL) receive up to 11 inches of annual precipitation. Precipitation in the Ajo, Gila Bend, and northeastern BMGR area is usually associated with thunderstorms that develop from moisture arriving from the Gulf of Mexico. Areas to the west and north of these locations are too far removed to be major beneficiaries of the summer rains associated with the moist Gulf air and too far south to benefit from the middle latitude storms that originate in the north Pacific Ocean and provide winter precipitation to Arizona. The mountain ranges to the west also prevent significant precipitation originating in the Pacific Ocean from reaching the study area.

As a result of the modest rainfall received in the study area, the relative humidities are generally low to moderate. Morning relative humidities may vary from 40 to 60 percent while summer afternoon values in the teens are not uncommon. The arid nature of the region is also illustrated by the evaporation rates. The National Weather Service measures evaporation using a standard evaporation pan called a Class A pan. Pan evaporation is a measurement that combines or integrates the effects of several climate elements: temperature, humidity, solar radiation, and wind. Evaporation is greatest on hot, windy, dry days and is greatly reduced when air is cool, calm, and humid (Farnsworth and others 1982). Class A Pan evaporation measurements taken at the Yuma Citrus Station, Arizona during 1963 to 1973 indicated a total annual pan evaporation of 104 inches with the maximum monthly average occurring in July (14 inches) and the minimum monthly average occurring in December (3 inches) (Sellers and Hill 1974).

TABLE 4-7
CLIMATOLOGICAL SUMMARY: MEAN TEMPERATURES AND PRECIPITATION IN THE VICINITY OF THE BMGR (1892-2000)

	Temperature (°F)					Precipitation (inches)			
	Yuma	Tacna	Ajo	Gila Bend		Yuma	Tacna	Ajo	Gila Bend
Monthly Average									
Jan	53.5	52.1	52.8	53.7		0.39	0.48	0.71	0.60
Feb	57.5	56.6	57.1	57.7		0.32	0.41	0.62	0.61
Mar	62.4	61.4	61.4	62.9		0.28	0.48	0.77	0.64
Apr	68.7	67.9	68.7	69.8		0.12	0.18	0.28	0.21
May	76.0	75.4	76.7	77.9		0.03	0.12	0.10	0.12
Jun	83.9	83.9	85.7	86.9		0.02	0.00	0.07	0.05
Jul	91.0	90.4	90.4	93.4		0.24	0.38	1.20	0.75
Aug	90.6	90.0	88.4	91.9		0.54	0.76	1.96	1.03
Sep	85.0	84.0	84.6	86.4		0.49	0.45	0.85	0.52
Oct	73.6	71.9	74.2	74.6		0.33	0.25	0.54	0.39
Nov	61.6	59.3	62.1	61.8		0.19	0.34	0.57	0.49
Dec	54.4	51.4	54.7	53.9		0.50	0.48	0.85	0.70
Annual	71.5	70.4	71.4	72.5		3.45	4.33	8.54	6.12
Daily Extremes									
Max.	124.0	126.0	117.0	122.0		4.29	2.88	4.15	2.61
MO/YR	7/95	7/95	7/95	6/90		08/77	08/77	09/46	08/51
Min.	19.0	13.0	17.0	10.0					
MO/YR	01/37	12/90	01/37	01/63					
Number of Days/Year									
>90° F	172.2	175.2	154.3	187.8	≥0.10 inches	8	11	19	15
<32° F	9.7	33.1	5.5	16.4	≥1.00 inches	1	1	2	1

Periods of Record

Yuma, AZ: 1920-2000
Tacna, AZ: 1969-2000
Ajo, AZ: 1914-2000
Gila Bend, AZ: 1892-2000

Source: Western Regional Climate Center 2001.

4.4.1.2 Meteorology

Surface Winds

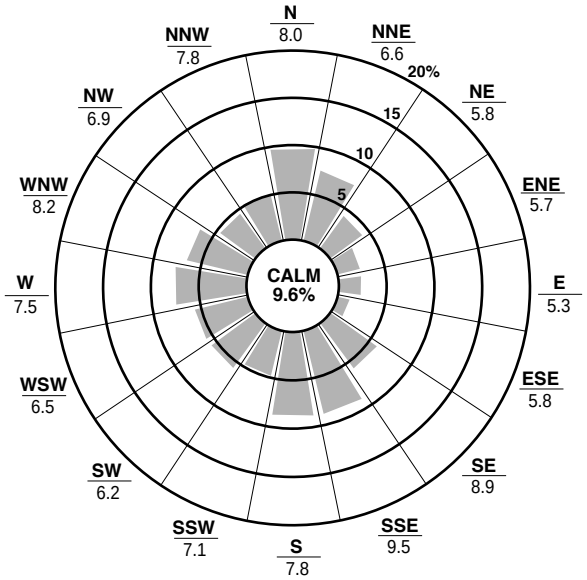
Readily available surface wind data for the study area are limited. Data are collected, however, by the National Weather Service at the Phoenix, Tucson, and Yuma airports. The average annual distribution of the surface winds at these locations is presented in Figure 4-5. The distribution of the surface winds at each location is influenced by topographic features, especially during those early morning periods when the drainage winds follow the terrain to lower elevations. Wind speeds in the area are moderate, averaging near 7 knots, although high winds do occur; peak wind gusts of more than 50 knots have been reported during nearly every month at Yuma during a 26-year period.

Atmospheric Stability

Atmospheric stability is an indication of the ability of the atmosphere to promote vertical movement of the air and therefore the mixing and diffusion of pollutants. The concept of stability can be explained through the use of an imaginary parcel of air that can be moved vertically in the atmosphere. During unstable conditions, if the parcel is moved upward, the parcel will continue to move upward once released. Under neutral conditions, the parcel will remain in the position at the time of release. During stable conditions, the parcel will return to its original location after release.

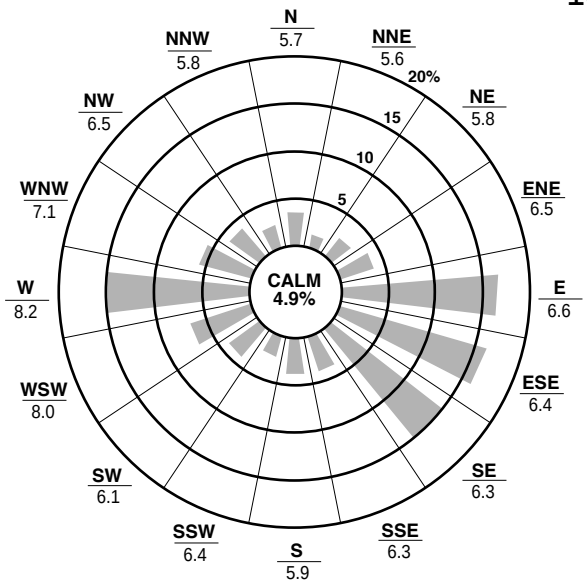
Several methods can be used to determine and report the stability. One method determines the stability using the net solar radiation and wind speed. These stabilities are reported in terms of Pasquill Stability Classes. These classes represent gradations of stability going from an extremely unstable condition, Stability Class A, to an extremely stable condition, Stability Class F. Class D represents neutral conditions; the remaining classes are intermediate gradations.

The stabilities at Yuma, Arizona were determined using this method and are summarized in Table 4-8. These data were readily available and are representative of conditions on the BMGR. The frequency of most of the stability classes changes with the seasons; only the neutral stability remains relatively consistent during the year. During the summer the frequency of stable and



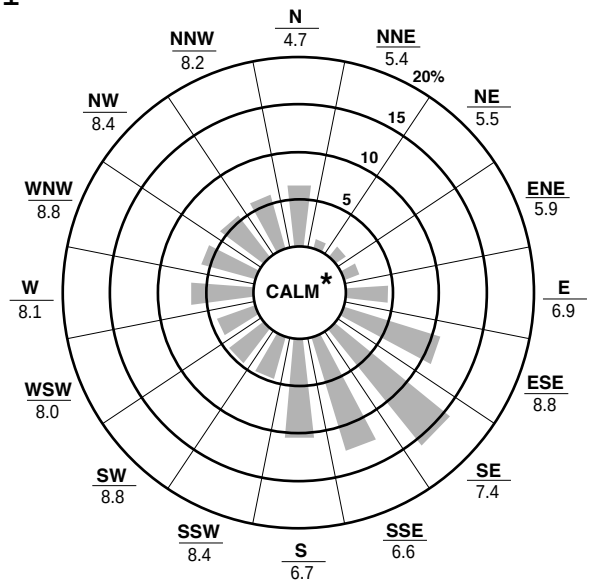
(Avg. Speed: 6.7 knots)

Yuma, AZ
1948-1971



(Avg. Speed: 6.4 knots)

Phoenix, AZ
1973-1975



(Avg. Speed: 7.4 knots)

Tucson, AZ
1984-1993

LEGEND

$$\frac{\textbf{SW}}{6.2} = \frac{\text{Wind Sector}}{\text{Avg. Wind Speed (Knots)}}$$

*** not available**

Sources: NOAA 1972, 1976.
WRCC 1997.

DISTRIBUTION OF SURFACE WINDS AT THREE LOCATIONS IN THE BMGR REGION

Figure 4-5

unstable conditions is relatively equal. As the year progresses and the temperatures decline, the frequency of stable conditions increases and the frequency of unstable conditions decreases. The maximum difference is observed during the winter when stable conditions occur nearly 60 percent of the time and unstable conditions occur approximately 15 percent of the time. During the spring as air temperatures increase, the trend reverses and the frequency of unstable conditions increases. Annually stable conditions are approximately equal to the sum of the unstable and neutral conditions. A typical diurnal progression of the atmospheric stability begins with poor diffusion in the evening and early morning; this is associated with cool temperatures and light winds. As the air temperature increases and wind speeds begin to increase, more vertical movement occurs. By late morning, sufficient heating has occurred to provide mixing to the prevailing upper level winds with primarily a westerly flow. During the late evening, as cooling occurs and wind speeds decrease, the atmosphere again begins to stabilize. During the winter when air temperatures are low, periods may exist when the atmosphere remains stable for the entire day. The frequency of stable conditions exhibited in Table 4-8 is not unusual; the diffusion capability of the area should not be considered a problem in regard to pollutant levels.

Mixing Height and Wind Speed

Another indication of the ability of the atmosphere to promote mixing and diffusion of pollutants is the mixing height. The mixing height (or depth) is defined as the height above the surface through which relatively vigorous vertical mixing occurs. These heights are determined from vertical temperature and associated wind speed profiles taken daily at various National Weather Service Stations throughout the United States at 8 a.m. and 4 p.m. local standard time.

TABLE 4-8
FREQUENCY OF ATMOSPHERIC STABILITIES (PERCENT)
FOR YUMA, ARIZONA 1967-1971

Pasquill Stability Class	Winter	Spring	Summer	Fall	Annual
A	0.1	2.8	4.2	1.1	2.1
B	3.4	11.8	13.1	11.2	9.9
C	11.1	20.1	21.7	15.1	17.0
D	28.2	23.2	23.5	21.3	24.0
E	19.2	14.1	14.9	13.9	15.5
F	38.0	27.9	22.6	37.6	31.5
Summary of Stability Conditions					
Unstable	14.6	34.7	39.0	27.4	29.0
Neutral	28.2	23.2	23.5	21.3	24.0
Stable	57.2	42.0	37.5	51.5	47.0

Source: National Oceanic and Atmospheric Administration 1972.

Mixing heights and wind speed are important in evaluating the dispersion of pollutants released from the ground and their impact on the ambient air quality. For example, a pollutant released during unstable conditions will spread rapidly in both the lateral and vertical directions. The vertical mixing will cease when the top of the mixing layer is encountered. During these unstable periods of high mixing heights, the impact of a released pollutant will be minimized by the large area into which it is mixed. Likewise during periods when the mixing height is low, the diffusion of the pollutant is less and impacts are higher.

During periods of very stable conditions, such as a ground-based inversion, both lateral and vertical mixing is restricted. A pollutant released into this atmosphere will seek equilibrium and remain at that level.

Mixing heights and associated wind speeds are not measured directly within the study area; however, isopleths (lines of constant values) of both parameters have been computed by the EPA (Holzworth 1972) from data collected during 1960 to 1964 at locations throughout the United States. These data may be used to characterize the mixing heights and wind speeds within the mixing layer for the area. Average mixing heights and wind speeds for the study area are presented in Table 4-9. Summer, winter, and annual average mixing heights and wind speeds for the morning (a.m.) and afternoon (p.m.) periods are shown.

TABLE 4-9
AVERAGE MIXING HEIGHTS AND WIND SPEEDS
IN THE BMGR STUDY AREA 1960-1964

	Mixing Height (meters)	Wind Speed (meters/second)
Summer a.m.	300-400	3-4
Winter a.m.	300	3-4
Annual a.m.	300-400	3-4
Summer p.m.	2400-2800	5-6
Winter p.m.	1200-1400	4-5
Annual p.m.	2000-2400	5-6

Source: Holzworth 1972

Average morning mixing heights and wind speeds appear to remain relatively unchanged during the seasons. Mixing heights of 300 to 400 meters (approximately 1,000 to 1,300 feet) with average wind speeds through the layer of 3 to 4 meters per second (m/s) [5.8 to 7.8 knots] are estimated for the summer, winter and as an annual average.

Average afternoon mixing heights are lower during the winter than during other seasons with wind speeds only slightly higher than those observed during the morning period. Average mixing heights reach the maximum during the summer with wind speeds of 5 to 6 m/s (approximately 10 to 12 knots).

The mixing layers observed are not uncommon. The average winter morning mixing height estimated for the area is also found over most of the United States from the Mississippi River to near the west coast. "The mixed layer is usually 300 to 3,000 meters in depth, although under conditions of large-scale dynamically induced instability, it may extend thousands of meters high" (U.S. Atomic Energy Commission 1968).

Episodes of Restricted Dispersion

The average mixing heights and wind speeds collected and reported by Holzworth (1972) were also used to tabulate periods (episodes) when specific meteorological conditions were satisfied; that is, periods of restricted dispersion. Tabulations were made for those episodes lasting at least two or five consecutive days with no precipitation and mixing heights of 500; 1,000; 1,500; and 2,000 meters and associated with average wind speeds through those mixing heights of 2, 4 and 6 m/s. From these data, isopleths of episode-days were prepared for the entire United States. The number of episode-days for mixing heights of less than or equal to 500 meters in the study area were estimated from these isopleths and are presented in Table 4-10. The 500-meter average mixing height data were selected for presentation to approximate the average morning mixing height estimated for the area (300 to 400 meters).

TABLE 4-10
EPISODES OF RESTRICTED DISPERSION
FOR THE BMGR STUDY AREA 1960-1964

Mixing Height	Wind Speed	Number of Episode Days
Lasting At Least Two Consecutive Days		
≤500 meters	≤2 m/s	0
≤500 meters	≤4 m/s	<50
≤500 meters	≤6 m/s	50-100
Lasting At Least Five Consecutive Days		
≤500 meters	≤4 m/s	0
<500 meters	≤6 m/s	<50

Source: Holzworth 1972

During the period of record there was no instance when the mixing height was less than or equal to 500 meters and the average wind speed was less than or equal to 2 m/s for at least two consecutive days. Episodes of mixing heights less than or equal to 500 meters with wind speeds less than or equal to 4 m/s (the average morning wind speed estimated for the area) and lasting for at least two consecutive days accounted for less than 50 days over the five-year period; none lasted at least five consecutive days. From this it may be surmised that in this area during the period of record, a mixing height of less than or equal to 500 meters with wind speeds less than or equal to 4 m/s did not last for five consecutive days.

4.4.1.3 Air Quality

Standards

The Federal Clean Air Act of 1970 established National Ambient Air Quality Standards (NAAQS) for six pollutants. These pollutants, referred to as the "criteria pollutants," include carbon monoxide (CO), nitrogen dioxide (NO_2), ozone, particulate matter (PM_{10}), sulfur dioxide (SO_2), and lead. Carbon monoxide is a colorless, odorless gas that primarily affects the cardiovascular system; vehicular emissions are a major source. Nitrogen dioxide is a gas with a yellowish-orange to reddish-brown appearance, depending upon its concentration, that impairs the respiratory system; major sources are power plants and vehicular emissions. Ozone is created through a complex reaction of hydrocarbons and oxides of nitrogen with sunlight as the primary catalyst; ozone affects the respiratory system. Sources of the ozone precursors include vehicle emissions, power plants, and service stations. Particulate matter refers to small aerosols that are suspended in the atmosphere and may cause irritation and damage to the respiratory system; vehicular emissions and the resuspension of road dust by vehicular activity are sources. Sulfur dioxide is a colorless gas generated by the combustion of sulfur-containing fuels, primarily affecting the respiratory system; major sources are power plants. Lead and its compounds damage the cardiovascular, renal, and nervous systems; the primary source is vehicular emissions associated with the use of leaded gasoline.

Two federal standards exist for most of the criteria pollutants. The primary standard defines levels deemed ". . . necessary, with an adequate margin of safety, to protect the public health." The secondary standard defines levels ". . . necessary to protect the public welfare . . ." (40 CFR Part 50). The promulgation of these standards, however, does not prohibit any State from establishing air quality standards that are more stringent. The federal standards are also subject to periodic review and revision as deemed necessary by the Administrator of the EPA.

In 1987, the standard for particulate matter was revised by the EPA from total suspended particulate matter (TSP), aerosols with diameters up to approximately 45 micron, to those aerosols with aerodynamic diameters of 10 micron or less. This new standard is referred to as PM_{10}.

In July 1997, the EPA revised the standards for both particulate matter and ozone (Federal Register 1997). The EPA revised the PM_{10} standard, added standards for particles with diameters of 2.5 micron or less ($PM_{2.5}$), and also revised the method for the determining exceedances. For ozone, the 1-hour standard was replaced with an 8-hour standard. In addition, the level of the ozone standard was lowered from 0.12 parts per million (ppm) to 0.08 ppm, and the method for determining exceedances was also revised. The effective date of these final rules was 16 September 1997. To ensure an effective transition to the new standards, the existing standards will remain in effect until it is determined that they have been met. The NAAQS for the criteria

pollutants are presented in Table 4-11 the State of Arizona standards are identical to the NAAQS.

TABLE 4-11
AMBIENT AIR QUALITY STANDARDS

		Federal/Arizona: mg/m^3 (ppm)[a]	
Pollutant	**Averaging Time**	**Primary**	**Secondary**
carbon monoxide	1-hour 8-hour	40 (35)[b] 10 (9)	* *
nitrogen dioxide	annual	100 (0.053)	100 (0.053)
Ozone	1-hour **8-hour**	235 (0.12) **(0.08)**	235 (0.12) **(0.08)**
PM_{10}	24-hour annual	150 50	150 50
$PM_{2.5}$	**24-hour** **annual**	**65** **15**	**65** **15**
sulfur dioxide	3-hour 24-hour annual	* 365 (0.14) 80 (0.03)	1300 (0.50) * *
lead	quarterly	1.5	1.5

a µg/m^3 stands for micrograms per cubic meter. ppm stands for parts per million.
b Carbon monoxide is measured in mg/m^3 - milligrams per cubic meter.
* No standard.
New standards in bold.
Sources: 40 CFR, Part 50; Arizona Administrative Code, Title 18, Article 2

Federal and Arizona standards for the criteria pollutants are not to be exceeded more than once per year, except in the case of the PM_{10}, $PM_{2.5}$, and ozone standards. Compliance for the PM_{10} and the 1-hour ozone standards is determined by the number of days on which the 1-hour ozone or PM_{10} standard is exceeded. The number of exceedance days per year, based on a 3-year running average, is not to exceed 1.0. For the 8-hour ozone standard, compliance is based on the annual average of the fourth highest daily maximum concentrations; the most recent three calendar years are used to assess compliance with the standard. For $PM_{2.5}$, the 24-hour standard is met when the three-year average of the 98th percentile values is less than or equal to 65ug/m^3; the annual standard is met when the three-year average of annual means is less than or equal to 15ug/m^3.

In response to the new standards for ozone and particulate matter, various petitioners challenged the promulgation of these standards by the EPA. The U.S. Court of Appeals for the District of Columbia Circuit Court ruled on 14 May 1999 that the EPA had over-stepped its legislative power in setting these new standards. On 27 February 2001, the United States Supreme Court ruled against the District Court of Appeals in this decision, but affirmed the judgment of the Court of Appeals on other issues such as not considering the costs of implementation in setting NAAQS. The Supreme Court also found the EPA's implementation policy for ozone to be unlawful. After their remand and the final disposition by the Court of Appeals, the Supreme

Court found that "…it is left to the EPA to develop a reasonable interpretation of the nonattainment implementation provisions insofar as they apply to revised ozone NAAQS."

Ambient Concentrations

Data collected during 1985 and 1998-2000 at four locations near the study area (Figure 4-4) were used to characterize the air quality in the study area and are presented in Table 4-12. Additional data for 1985 have been included to illustrate any improvements in the ambient levels that may have occurred; this was also the most recent data available for levels of sulfur dioxide at Ajo, Arizona. With the exception of PM_{10}, the availability of data summaries for the criteria pollutants in the area is very limited.

Of the six criteria pollutants addressed by the NAAQS, only ozone approaches the NAAQS in the vicinity of the study area. A summary of the relation of the observed area concentrations to the NAAQS is presented in Table 4-12. The percentages represent the ratio of the average of the observed values during 1998-2000 for each pollutant (except sulfur dioxide which used the 1985 data) and the referenced standard. The air quality over the study area may be considered good to excellent.

PM_{10}

PM_{10} is monitored at all of the four locations illustrated in Figure 4-4. None of the annual averages at these locations have exceeded the annual standard and, at the three locations having data from 1985, ambient concentrations have decreased during the last 15 years. Sources of PM_{10} include agricultural activities, resuspension of road dust by vehicular traffic, wind blown dust, motor vehicle exhaust, open burning, material handling, major point sources such as power plants, or any activity that forces the suspension of small particles

Ozone

Ozone is the result of a reaction in the atmosphere of volatile hydrocarbons with oxides of nitrogen. This reaction is promoted by the presence of sunlight and high air temperatures. Ozone concentrations are generally greater in the afternoon because of this. Because of the necessity for mixing of the two precursors, ozone is more of a regional concern than that associated with more localized sources of pollution such as PM_{10}. Sources of the ozone precursors are emitted largely by motor vehicles. Secondary sources include gasoline marketing and storage areas for the hydrocarbons, and power plants and industrial boilers for the oxides of nitrogen. Levels of ozone observed at Yuma during 1998-2000 are decreasing, concentrations obtained at Casa Grande are slightly increasing.

TABLE 4-12
AIR QUALITY SUMMARY: BMGR AIRSPACE REGION
1985, 1998-2000

		Yuma	Ajo	Casa Grande	Organ Pipe Cactus NM
CO (8-Hr Max)	2000	-	-	0.9ppm	-
	1999	-	-	0.8 ppm	-
	1998	-	-	1.5 ppm	-
	1985	5.0 ppm	-	-	-
NO_2 (Annual Avg.)	2000	-	-	-	-
	1999	-	-	-	-
	1998	-	-	-	-
	1985	-	-	-	-
Ozone (1-Hr Max)	2000	0.077 ppm	-	0.105 ppm	-
	1999	0.103 ppm	-	0.098 ppm	-
	1998	0.109 ppm	-	0.093 ppm	-
	1985	0.110 ppm	-	-	-
PM_{10} (Annual Avg.)	2000	42.3 ug/m^3	18.2 ug/m^3	34.7 ug/m^3	12.2 ug/m^3
	1999	37.0 ug/m^3	20.8 ug/m^3	35.3 ug/m^3	10.0 ug/m^{3a}
	1998	39.0 ug/m^3	21.0 ug/m^3	31.0 ug/m^3	8.0 ug/m^3
	1985	63.0 ug/m^3	41.0 ug/m^3	-	16.0 ug/m^3
SO_2 (Annual Avg.)	2000	-	-	-	-
	1999	-	-	-	-
	1998	-	-	-	-
	1985	-	40.0 ug/m^3	-	-
Lead (Qtrly Avg.)	2000	-	-	-	-
	1999	-	-	-	-
	1998	-	-	-	0.050 ug/m^3
	1985	-	-	-	0.020 ug/m^3

Relation of Area Concentrations to NAAQS

Pollutant (Avg. Time)	NAAQS	Percent NAAQS
CO (8-hour)	9 ppm	12
NO_2 (Annual Avg.)	100 ug/m^3	36*
Ozone (1-Hr)	0.12 ppm	81
PM_{10} (Annual Avg.)	50 ug/m^3	52
SO_2 (Annual Avg.)	80 ug/m^3	50
Lead (Qtrly Avg.)	1.5 ug/m^3	3

ppm = parts per million
µg/m^3 = micrograms per cubic meter
"-"= no available data
* = from Tucson
Source: Arizona Department of Environmental Quality 1986, 1999, 2000, 2001

Carbon Monoxide

Motor vehicles are a major source of carbon monoxide; minor sources include aircraft, agricultural or forestry burning, and industrial facilities. Like PM_{10}, carbon monoxide is more of a localized pollutant due to its buoyancy and ability to disperse under normal conditions. However, during those periods when the air is stagnant, such as with a ground-based inversion, levels of carbon monoxide can increase. Levels of carbon monoxide are usually highest during the winter months when inversions occur more frequently. Levels of carbon monoxide in the study area can be expected to be well below the NAAQS, especially those areas removed from extensive vehicular traffic associated with urban areas.

Sulfur Dioxide

Of the air quality data reviewed, sulfur dioxide data are the most incomplete. During 1985, sulfur dioxide levels at Ajo, Arizona, which was near a smelter (a potential major source), were approximately 50 percent of the NAAQS. After that date, the smelter was deactivated and monitoring was discontinued. Levels of sulfur dioxide in the study area can be expected to be very low due to the lack of major sources. However, the area around Ajo was not redesignated to attainment status for sulfur dioxide.

Nitrogen Dioxide

Like carbon monoxide and sulfur dioxide, levels of nitrogen dioxide can be expected to be well below the NAAQS in the study area. Annual air quality reports prepared by the ADEQ back to 1981 were reviewed for monitoring data in the area; none exist. The annual average concentration of nitrogen dioxide obtained in Tucson during 2000 was well below the standard.

Lead

The remaining criteria pollutant is lead. Lead is emitted primarily by motor vehicles that burn leaded gasoline. Because the use of leaded gasoline has declined substantially over the years, lead concentrations are well below the standard even in large, urbanized areas such as Phoenix and Tucson. Lead concentrations obtained at the Organ Pipe Cactus NM are well below the standard; it may be assumed that levels of lead in the study area are very low.

Nonattainment Areas

The Clean Air Act Amendments of 1990 authorized the EPA to designate those areas that have not met the NAAQS as nonattainment and to classify them according to their degree of severity.

States that fail to attain the NAAQS for any of the criteria pollutants are required to submit State Implementation Plans (SIPs), which outline those actions that will be taken to attain compliance.

The air quality in the study area is generally excellent. Much of the area is very remote with little development. Although ambient air quality data for the area are very limited, available data indicate that, even in the more urbanized areas, levels of most of the criteria pollutants are well below the NAAQS.

To preserve those areas that have air better than the NAAQS, designated as attainment areas, the Clean Air Act established the Prevention of Significant Deterioration (PSD) Program. The PSD regulations divide the attainment areas within the United States into three classes of air quality. The Class I areas, such as national parks and wilderness areas, have pristine air and almost no increase in air pollution is allowed. Additionally, some of the Class I areas have also been identified as having important visibility value. Class II areas allow moderate development and Class III areas allow extensive development. There is no Class I area within the study area boundary; this area is considered a Class II category.

Those areas of the country in which the air quality does not meet the NAAQS for one or more pollutants are identified as non-attainment areas. For these areas, states are required to formulate and submit SIPs to EPA that outline those measures that will be used to attain and maintain the NAAQS. The general outlines of the existing federal and state non-attainment areas in the study area are presented in Figure 4-6. This figure is not meant to imply that there are no other non-attainment areas in Arizona.

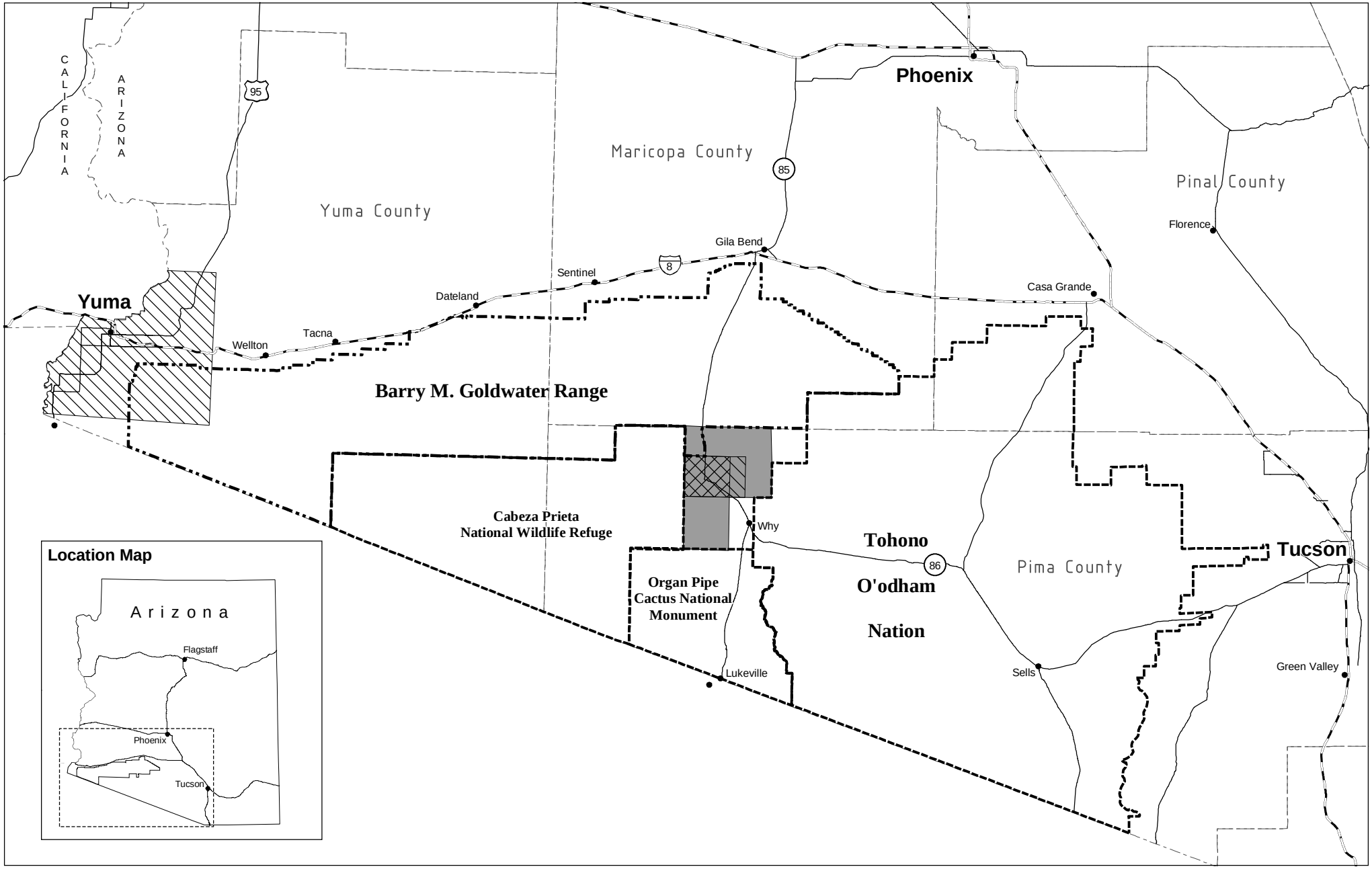
The existing non-attainment areas outlined in Figure 4-6 are described in Table 4-13. For PM_{10}, all those areas designated non-attainment were classified as "moderate" at the time of the designation; reclassification to "serious" may occur if the standards cannot be attained. The classifications for Ajo may be remnants from a time when a smelter operated in Ajo.

TABLE 4-13
FEDERAL AND STATE NON-ATTAINMENT AREAS

Area	Pollutant	Classification
Ajo	SO_2	Does not meet Primary Standards
	TSP*	Does not meet Primary Standards
	PM_{10}	Moderate
Yuma	PM_{10}	Moderate

* TSP = total suspended particulate matter
Source: 40 CFR Part 81

The 1990 Clean Air Act Amendments set a deadline of 15 November 1991 for submitting SIPs to the EPA for those areas in a state not attaining the PM_{10} NAAQS. The SIPs must demonstrate that:



N

10 5 0 10 20

Scale in Miles

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Legend

- Total Suspended Particulates (TSP)
- Particulate Matter (PM_{10})
- Sulfur Dioxide

Non-Attainment Areas in the BMGR Vicinity

Figure 4-6

- the area will, with the implementation of the plan, attain the NAAQS for PM_{10} by 31 December 1994 or show that attainment by that date is impracticable

- Reasonably Available Control Measures (RACM) and Reasonably Available Control Technology (RACT) are committed to be implemented by 10 December 1993

The State of Arizona submitted SIPs for those PM_{10} non-attainment areas shown in Figure 4-6. Both the Ajo and Yuma PM_{10} SIPs have been received by EPA and are considered complete. There are currently no SIPs for the sulfur dioxide and TSP non-attainment areas around Ajo.

4.4.2 Interrelationship Between the Military Mission and Climate/Air Resources

4.4.2.1 Climate/Meteorology

The climate and meteorology of this vast area is completely independent of the military mission; increases or decreases in the duration or magnitude of the mission will have no impact on the climate or meteorology of the BMGR. Conversely, however, climate and meteorology may impact the mission, depending upon the guidelines established for mission operations. For example, temperature extremes, high winds, and/or lightning could potentially affect the types of operations that may be conducted.

4.4.2.2 Air Quality

The air quality of any area is dependent upon the activities (emissions) present. With the exception of small areas that are considered nonattainment, the air quality of the BMGR is generally excellent due to its vastness and lack of major pollution sources. Of the criteria pollutants, particulate matter may be the most directly tied to the military mission. Mobile sources, such as trucks, can contribute to the ambient concentrations of particulate matter through the disturbance of the soil, which causes the suspension of particulate matter, and through diesel exhaust, which is a major source of very small particulate matter. Munitions delivery may also contribute to the suspension of particulate matter, and flash-burning of expended munitions as part of the EOD clean-up process may contribute to the ambient levels of particulate matter. These military activities, however, are typically sporadic, wide-spread, and of short duration. Increases in the duration or magnitude of the mission are likely to have little or no impact on the air quality of the BMGR.

4.4.3 Existing Statutory and Regulatory Requirements and Management Plans and Actions

4.4.3.1 Regulatory and Statutory Requirements

The EPA is responsible for administering the Clean Air Act. This includes designating those areas that have not met the NAAQS as nonattainment areas and classifying them according to their degree of severity. States that fail to attain the NAAQS for any of the criteria pollutants are required to submit a SIP, which outlines those actions that will be taken to attain compliance. ADEQ prepares the SIP for Arizona and EPA is responsible for approving the SIP.

The Maricopa Association of Governments (MAG) provides regional planning and policy decisions to address long-range planning and policy development on a regional scale in several areas including transportation and air quality. Pinal Association of Governments (PAG) serves a similar role for portions of Pinal County.

Agencies with administrative, management, or operational responsibility for the BMGR are required to comply with applicable federal laws, and to the extent sovereign immunity has been waived, federal agencies are also required to comply with applicable state and local air quality laws. A list of the major laws is provided below:

- *Clean Air Act (40 CFR 50 and 51)*, amended in 1977 and 1990. This Act established the NAAQS that must be maintained nationwide. The Act authorizes state and local agencies to enforce the NAAQS. State and local agencies may establish their own standards, but these standards must be as stringent at the NAAQS.

- *Section 110 of the Clean Air Act* requires states to adopt and submit to the EPA plans that provide for "…the implementation, maintenance and enforcement of air quality standards within a specific time after standard promulgation." These plans are called the State Implementation Plans.

- *Section 182(c)(1) of the 1990 Clean Air Act Amendments* directs the EPA administrator to promulgate rules for the enhanced monitoring of ozone and ozone precursors, i.e., oxides of nitrogen (NO_x) and volatile organic compounds (VOCs) for the purpose of improving strategies for attaining the ozone standards.

- *Arizona Administrative Code, Title 18.* Title 18 of the Code established the Arizona Department of Environmental Quality and set ambient air quality standards for Arizona. It also provides ambient standards for hazardous air pollutants and emission standards for

mobile sources. The emission standards for mobile sources apply only to portions of Maricopa and Pima counties.

4.4.3.2 Management Plans and Actions

Management actions identified in the Lower Gila South RMP (Goldwater Amendment) that are applicable to air quality include (1) ensure compliance with Clean Air Act Standards, and (2) develop Best Management Practices for any activity with the potential for generation of non-point source pollution.

Actions identified in the SIPs that would apply to the BMGR are those that deal with areas that are within a nonattainment area. The State of Arizona has submitted SIPs for the PM_{10} nonattainment areas at Ajo and Yuma to the EPA and are considered complete. Currently the Ajo nonattainment area for TSP, PM_{10}, and sulfur dioxide is being considered for reclassification to attainment.

4.4.4 Information Not Currently Available to Support Climate and Air Resource Management

Only one potential shortfall in specific data or information related to climate and air resources that would pose potential challenges for the future management of BMGR was identified during the preparation of the affected environment section of this EIS. The information not currently available would be helpful as it pertains to ecosystem management rather than of climate and air resources within the BMGR. Specific rangewide data on air quality, precipitation, ground moisture, and temperature could be used to support BMGR ecosystem and regional Sonoran Desert ecosystem management. This does not, however, constitute incomplete or unavailable information needed to conduct the environmental impact analysis presented in Chapter 5 in accordance with 40 CFR §1502.22.

4.5 GENERAL VEGETATION

4.5.1 Existing Conditions

4.5.1.1 Ecoregional Context

The Sonoran Desert supports a rich variety of more than 2,000 plant species. From cacti to sand-dwelling underground root parasites, some seventeen different growth forms coexist within the region (Phillips and Comus 2000). Flora has evolved in response to unreliable and uneven bi-seasonal rainfall patterns separated by periods of spring and fall drought, and freezing

temperatures of short duration. The Sonoran Desert differs primarily from the other North American deserts in having mild winters in which freezing temperatures, if they occur at all, are of short duration (Brown 1994, Phillips and Comus 2000). The bimodal rainfall pattern and milder winters allow for a greater structural diversity than in the Great Basin, Mohave, and Chihuahuan deserts. While other North American deserts are dominated by low shrubs, the Sonoran Desert vegetation has a diverse mix of tree, tall shrub, succulent life forms, and large cacti. In particular, the Sonoran Desert is distinguished from the other North American deserts by its leguminous trees and large columnar cacti. About 50 percent of the species recorded in local Sonoran Desert floras are annuals and 60 percent to 80 percent of these are winter annuals (Venable and Pake 1999). Some of the plant species most likely to be found within the BMGR region (including the Cabeza Prieta NWR) are listed by both common and scientific names in Appendix D, Table D-1. Only common names are referred to in the text.

The proximity of the Sonoran Desert to differing biotic communities, including chaparral, woodland, and grassland communities also contributes to this diversity. Toward the north, especially on mountain slopes, the vegetation ranges toward chaparral, which is characterized by dense thickets of fire-adapted evergreen shrubs. Toward the northwest, the Sonoran Desert merges with the Mohave Desert where summer rainfall is usually scarce. In the Mexican state of Sonora to the south, summers are longer and wetter with a drier winter. Drought-tolerant, deciduous trees and shrubs become increasingly common, many of which are quite thorny. Succulent cacti are abundant and diverse. The Sonoran Desert gradually merges with the more southerly Tropical Dry Thorn Forest of southern Sonora and Sinaloa. To the east, the Sonoran desertscrub merges with semidesert grassland, or more unusually, Chihuahuan desertscrub (Phillips and Comus 2000).

The Sonoran Desert, along with the other North American deserts, has evolved in response to large-scale gradual changes in climate, shifting from woodland to desert around 8,000 to 9,000 years ago. As a result, many plants of the Sonoran Desert are derived, relatively recently, from more subtropical ancestors to the south. To survive during long periods of drought, the vegetation has adapted three main strategies—succulence, drought tolerance, and drought evasion. While barrel cactus, saguaro cactus, and succulents like agave have adapted means of water storage, others such as the mesquite tree have developed a deep root system to tap into underground moisture. The creosotebush utilizes a combination of many adaptations. For protection, it relies on a smell and taste that wildlife find unpleasant. It has tiny leaves that close their pores during the day to avoid water loss and open at night. Creosotebush has an extensive double root system, both radial and deep, to accumulate water from both surface and ground water. Other plants survive by remaining dormant during dry periods of the year, then quickly springing to life when water becomes available. For example, the ocotillo sprouts new leaves to photosynthesize within days of rainfall. Most desert annuals germinate only after heavy seasonal rain, then complete their life cycle quickly. Summer annuals may germinate and produce seed within three weeks. Heat- and drought-resistant seeds of annuals may remain dormant in the soil for decades, waiting for suitable growing conditions. These adaptations allow the plants of the

Sonoran Desert not only to survive, but to thrive under the climactic conditions present. The saguaro cactus, for example, would not survive in any other biome—it would rot, freeze, or be shaded out by faster growing plants (Phillips and Comus 2000).

More recently, vegetation of the Sonoran Desert has been altered by the introduction of non-native, invasive plant species. As reported by Phillips and Comus (2000), Conservation International has estimated that as much as 60 percent of the entire Sonoran Desert surface is no longer covered with native vegetation but is dominated by the 380-some alien species introduced to the region by humans and their livestock. Another estimate is that the number of non-native plants has risen from 190 species in 1942 to approximately 330 species in 2000. Lehmann's lovegrass, a South African grass introduced in the 1930s to control erosion now covers more than 40,000 acres in Arizona. Beginning in the 1960s, another African grass, buffelgrass, was introduced to increase forage production. Buffelgrass now covers more than 1.4 million acres of the region. Some invasive weeds, such as Sahara mustard, have been found in even the most remote Sonoran Desert regions (Phillips and Comus 2000). Known from only a few locations in 1987, Sahara mustard is now perhaps the most common roadside annual in southern Arizona. Disturbed and undisturbed areas are both inhabited by the plant. Biologists are concerned that the Sahara mustard is out-competing native annuals and may be affecting both vegetation and wildlife in the desert southwest (BLM Yuma Field Office and AGFD 1997). The competitive relationship between native and non-native plants is not well understood in the desert environment, but it is likely that some native species lose to invaders and that dominance of the annual flora by non-natives has significant ecosystem effects. For example, non-native invasive species are not favored forage plants for native species; as a result, the food base and productivity of the habitat may decrease. The ability of invasive plants to carry fire also can cause habitat disturbance. While fires on the BMGR have been infrequent and generally confined to relatively small areas, natural fire frequency and intensity may be altered by the introduction of non-native plant species such as buffelgrass. Fire under these circumstances potentially can be an extremely powerful and disruptive force that alters the natural composition, structure, and function of natural communities.

4.5.1.2 Sonoran Desert Subdivisions and Plant Classification Systems

The Sonoran Desert is characterized by six natural plant community subdivisions that represent the interactions of distinctive botanical features. Of these six subdivisions, only two, the Arizona Upland and Lower Colorado River Valley, are present in Arizona. The plant communities of most of BMGR—West and western BMGR—East are best characterized as being within the Lower Colorado River Valley Subdivision. The plant communities within the eastern part of BMGR—East are predominantly representative of the Arizona Upland Subdivision (Turner and Brown 1982). Vegetation within the Arizona Upland community of the BMGR is relatively less densely stocked compared to similar communities farther to the east in Arizona. Conversely, the vegetation within the Lower Colorado River Valley community of the BMGR is more densely

stocked than similar communities farther to the west in California. This is primarily because the annual rainfall gradient in southern Arizona and southeastern California declines markedly from east to west. Tucson, located approximately 100 miles east of the BMGR, averages about 12 inches of precipitation per year while Yuma, located within a few miles to the west of the BMGR, averages about 2.5 inches per year. Topography, drainage, soils, and other climatic factors are also important geomorphological influences on BMGR vegetation (U.S. Air Force 1986).

The Arizona Upland comprises the highest and coldest areas in the northeastern portion of the Sonoran Desert at elevations between 450 and 3,100 feet. The vegetation of this subdivision exceeds that of the Lower Colorado River Valley in stature, density, and number of dominant and subdominant species. This is primarily due to the greater amount of precipitation associated with the Arizona Upland. This region often appears to be a scrubland or low woodland of leguminous trees, with intervening spaces filled by layers of shrubs, perennial succulents, and cacti (Turner and Brown 1982).

Arizona Upland vegetation is found on rocky bajadas, foothills, and mountain slopes and is best developed on the BMGR east of State Route 85. Vegetation is structurally diverse and is represented by saguaro, foothill paloverde, ocotillo, and a wide array of cholla, prickly pear cactus and shrubs. A large number of plant associations are characteristic of this subdivision and are present locally in response to soil conditions, slope exposure, and average annual rainfall. On the extreme eastern edges of the BMGR, the Arizona Upland Subdivision is mixed with desert grassland and some chaparral elements. Species such as Arizona rosewood are present along with a wide array of grasses and shrubs. Elements of the Arizona Upland Subdivision persist in the mountain ranges west of State Route 85, but the number of plants is often reduced. Many of the characteristic understory shrubs present in the Sand Tank and Sauceda mountains are nearly absent from the Mohawk Mountains to the west. Most notable is the attenuation of numbers of saguaro cacti and foothill paloverde in the western mountains. Paloverde and saguaro also become nearly obligate riparian species in the more arid western mountain ranges (Dames & Moore 1996).

The Lower Colorado River Valley Subdivision is the largest, hottest, and driest subdivision. Plant growth is typically sparse due to the combination of high temperature and low precipitation. The Lower Colorado River Valley Subdivision is a totally shrub dominated community. The two most drought-tolerant perennial plants in North America, creosotebush and white bursage (Phillips and Comus 2000), compose the most widespread and important plant community of the Lower Colorado River Valley Subdivision.

The vegetation within the Arizona Upland and Lower Colorado River Valley subdivisions can be further classified into plant communities, or series (Brown and others 1979, Turner and Brown 1982). The Lower Colorado River Valley Subdivision is dominated by the Creosotebush-White Bursage Series and Saltbush Series. While these two series dominate plant communities within

this subdivision on the BMGR, two less important series also occur on the BMGR—the Creosotebush-Big Galleta Series and Mixed Scrub Series. Creosotebush and white bursage are the major vegetation types on the plains and lower bajadas of the BMGR. The remaining small percentage of vegetation consists of shrubs and cacti, which are predominant in the upper bajadas and mountains. Saltbush Series is representative of the vegetation occurring on the gently sloping lands and valleys of the BMGR. Generally, the soils on which this series is dependent are very fine, have a higher capacity for water retention, and are more alkaline than soils occupied by the Creosotebush-White Bursage Series. Much of the land in the vicinity of the BMGR that has been converted to agricultural use formerly supported large expanses of saltbush. Within BMGR—East, this Saltbush Series is quite limited and is not present over any large expanses of land (U.S. Air Force 1986).

The Arizona Upland Subdivision is subdivided into three series, although only the Paloverde-Cacti-Mixed Scrub Series is of significance on the BMGR. Foothill paloverde and saguaro dominate the series, with ironwood playing a secondary role. This series is better developed on the BMGR on bajadas and mountain slopes. A common feature along the margins of many valleys in this region is a transition zone between this series and the Creosotebush-White Bursage Series. Where the valley floor and the base of adjacent bajadas make contact, triangle-leaf bursage often grows along minor water courses. As elevation increases, the ecologically complementary white bursage begins to diminish and triangle-leaf bursage can be found on all aspects of the terrain. Still higher, foothill paloverde, ironwood, and saguaro become increasingly prominent. Creosotebush is found in this area, but is primarily an understory species (Turner and Brown 1982, U.S. Air Force 1986).

4.5.1.3 BMGR Natural Communities

The east-west orientation of the BMGR extends approximately 135 miles in length and the topographic relief is quite varied. Consequently, there is a wide range of environmental variation in precipitation and temperature. It is not uncommon for the eastern portion of the BMGR to experience average annual precipitation that is three- to four-times greater than that experienced on the western portion of the range (Brown 1994).

Because the BMGR is so environmentally variable, it also has a corresponding natural variation in composition, structure, and function of its plant communities (Felger and others 1997). The relatively cool, moist microsites afforded by the Sand Tank Mountains enables species more typical of higher elevations such as jojoba to persist, whereas the lack of freezing temperatures in the western portion of the range enables plant communities to establish whose composition includes species intolerant of freezing temperatures, such as elephant tree. Fire has not been an important factor in the evolution or composition of vegetative communities on the BMGR (see Section 4.8). The few areas within the BMGR where vegetation is actively maintained as landscape features, such as portions of the Gila Bend AFAF, are addressed in Section 4.9.

Although a comprehensive survey of plants on the BMGR has not been completed, it is estimated that there may be up to 500 species of plants present on the BMGR (U.S. Air Force 1986 and U.S. DOI, NPS 1997). A recent survey found 120 species of flora in 35 families present within the Mohawk Dunes ecological community alone (Felger and others 1998). A list of the common and scientific names of plant species that may occur in the vicinity of the BMGR, including the Cabeza Prieta NWR, is provided in Appendix D, Table D-1.

As a part of the planning process for the INRMP, TNC, in coordination with a panel of experts, analyzed the ecological structure, composition, and processes on the BMGR and developed 13 natural community elements. Nine of these 13 natural communities and their estimated acreage within the BMGR are as follows:

- Valley Bottom Floodplain Complex—29,000 acres
- Dune Complex and Dune Endemics —30,000 acres
- Creosotebush-Bursage Desertscrub—1,290,000 acres
- Creosotebush-Big Galleta Scrub—24,500 acres
- Paloverde-Mixed Cacti-Mixed Scrub on Bajadas—210,000 acres
- Paloverde-Mixed Cacti-Mixed Scrub on Rocky Slopes—45,000 acres
- Sand Tank Mountains Uplands —10,700 acres
- Elephant Tree-Limberbush on Xeric Rocky Slopes—90,600 acres
- Desert Playa—170 acres

Two xeroriparian communities are associated with washes. The extent of these communities is best described in the following linear terms:

- Valley Xeroriparian Scrub—2,325 linear miles
- Mountain Xeroriparian Scrub—400 linear miles

Salt Desertscrub and Desert Tinajas/Springs are the twelfth and thirteenth communities. The area occupied by these communities is represented by point data and the areas of these communities have not been estimated.

Natural communities represent an integration of ecosystem attributes, including biotic and abiotic composition, structure, and function, at scales that are practical and applicable to conservation planning. These natural communities defined by TNC are somewhat parallel to plant classifications (Brown and others 1979, Turner and Brown 1982), but attempt to account, at least in part, for the non-static nature of floristic composition incorporating abiotic features as part of the description for some community types. Because natural communities are dynamic, TNC advocates that the appropriateness of each natural community as a coarse filter for biodiversity be periodically assessed and revised as necessary. More detailed information about the way that the natural communities were classified can be found in Hall and others (2001).

The 13 BMGR natural communities, first introduced in Section 2.6.2 and shown on Figure 2-5, are described in detail in terms of ecological characteristics (composition, structure, function/ecological process, physiographic occurrence, and associated soil characteristics) in Table 4-14, and in terms of status and threats purported by TNC (historic and current distribution, conservation status, stressors, and sources of stress) in Table 4-15.

4.5.2 Interrelationship Between the Military Mission and General Vegetation Resources

There are many notable interrelationships between the military mission and vegetation resources on the BMGR. One of the most tangible is the camouflage effect of vegetation and how it is used in target simulations on the tactical ranges to provide realistic combat training. For example, in simulated vehicle convoys on the tactical ranges, car bodies that have been painted olive green are aligned near washes where they could easily be mistaken for trees or large shrubs, as they are distributed along washes and are similar in size and color. Simulated anti-aircraft artillery positions are often located in relatively densely vegetated areas as would often be the case in an actual wartime mission. This camouflage, cover, and shelter of vegetation is also an important asset during troop deployment exercises, such as WTI, and during desert survival skills training, which is part of some bivouac exercises.

Another interrelationship involves the consumptive use of vegetation resources in training. Training can degrade vegetative communities making the land unsuitable for future use. Extrapolating from estimates provided in the LEIS for the renewal of the BMGR (U.S. Air Force 1999), military training activities on the BMGR cause low to moderate levels of disturbance of vegetation on about 6.9 percent of the range surface and subject an additional approximately 3 percent of the range surface to more substantial levels of disturbance (see Table 4-5). By the nature of tactical military aviation training, most impacts occur in the lowland areas. For example, the placement of the simulated airfield and associated structures in the tactical ranges is meant to simulate where an enemy airfield and associated facilities might be located in the battlefield—on a level valley bottom, protected by adjacent, camouflage-providing mountains. By virtue of plant distribution patterns, most lowland vegetation is less diverse and less dense in these low-lying areas.

Lowland vegetation in target areas is affected by EOD clearances. The areas currently affected by one-year and five-year EOD clearances are about 34,100 acres and 61,000 acres, respectively. From 1976 to 2001, the total five-year clearance area was about 96 percent larger, but was reduced in the fall of 2001 from a distance of one nautical mile from the target to one kilometer because the improved accuracy of aircraft weapons delivery systems has reduced the extent of target impact areas affected by munitions delivery training (see Table 4-5). Vegetation communities in five-year EOD clearance areas are largely intact, whereas in annual clearance areas vegetative cover is somewhat less.

TABLE 4-14
ECOLOGICAL CHARACTERISTICS OF BMGR NATURAL COMMUNITIES AS ASSESSED BY TNC

Natural Community Element	Composition	Structure	Function/Ecological Process	Physiographic Occurrence	Associated Soil Characteristics
Valley Bottom Floodplain Complex	Characteristic vegetation includes creosotebush, triangle-leaf bursage, white bursage, acacias, paloverdes, mesquites, and annual and perennial grasses.	Community occurs as patchy shifting mosaics of sparse vegetation in the relatively dry areas interspersed with dense vegetation within shallow depressions where water accumulates. Linear occurrences of vegetation characteristic of the Valley Xeroriparian Scrub community may be present within this complex.	Forms on nearly flat terrain (valley bottoms) where sheet flow may be an important hydrological phenomenon. Vegetation provides forage, cover, nest sites and perches for wildlife.	Vegetation is located at the base of pediments and extends onto valley floors. Examples within the BMGR are found in the Growler and San Cristobal Valleys.	Generally forms on deep loams and sandy loams that are often prone to accelerated erosion.
Valley Xeroriparian Scrub	Characteristic vegetation is highly variable and includes blue paloverde, ironwood, mesquite, foothill paloverde, herbaceous and woody perennial vines, and sparse annual grasses and forbs.	Found in narrow linear strips in downcut channels with a moderate to dense layer of trees and shrubs that are generally less than five meters tall. Herbaceous layer typically is sparse.	Channel-constricted flow is the dominant ecological process. Frequency and amount of runoff, shading, and channel scouring influence xeroriparian vegetation gradients.	Found on mountain slopes with less than 6 percent grade and extending onto valley bottoms. On the BMGR, this community is most predominant in the more arid areas west of State Route 85. Daniels Arroyo is a good example.	Generally located on course-textured substrates, but also gravelly silty loams.
Mountain Xeroriparian Scrub	Characteristic vegetation is highly variable but typically consisting of paloverdes, ironwood, mesquites, and succulents.	Found in narrow linear strips in downcut channels with a moderate to dense layer of trees and shrubs that are generally less than five meters tall. Herbaceous layer typically is sparse.	Channel-constricted flow is the dominant ecological process.	Community is found on upper bajadas and low- to moderate- elevation mountain slopes with more than a 6 percent grade.	May be on exposed bedrock on upper mountain slopes. Soils are generally not saline.
Dune Complex and Dune Endemics	Complex is generally sparsely vegetated by scattered forbs and grasses. May include shrubs and dwarf-shrubs such as white bursage. Stabilized dunes may support creosotebush and mesquites while active dune fields may lack vegetation.	Community occurs as patchy shifting mosaic within Creosotebush-Bursage Desertscrub. Includes active open dunes, stabilized dunes, and stabilized flat "sand sheets." This complex has a sparse and seasonally variable herbaceous layer with a sparse cover of shrubs that are less than two meters tall.	Contains a high number of endemic species that have adapted to moving sand. Water may be held for long periods just under the surface by sand.	Active, stabilized, and partially stabilized dunes found in valleys. On the BMGR, dune complexes are found west of the Mohawk Mountains, in the Gran Desierto southeast of Yuma, in San Cristobal Valley, and in the northern Growler Valley.	Area consists of sand dune complexes.
Creosotebush-Bursage Desertscrub	Vegetation is primarily dominated by creosotebush. Woody and non-woody cacti and rosette succulents commonly occur on rocky slopes. Seasonally present perennial grasses with some perennial forbs dominate the sparse herbaceous layer.	Includes extensive networks of Valley Xeroriparian Scrub communities with large patches of active and stabilized dune complexes. Vegetation typically includes sparse to moderately dense layers of microphyllous and broad-leaved evergreen subshrubs and shrubs less than two meters tall.	Linear xerioriparian systems and large patch dune fields nested within the creosotebush-bursage "matrix" dominate.	Community is found on lower bajadas and intermountain basins that are generally flat or on gentle to moderate slopes. The lower bajadas and valley west of the Sauceda Mountains is a good example of this community.	Substrate is usually sandy or gravelly alluvium derived from limestone and metamorphic rocks. Soils are typically of low salinity.
Creosotebush-Big Galleta Scrub	Dominant shrub is Creosotebush. Big galleta is the sole or dominant grass in the herbaceous layer. White or triangle-leaf bursage can be a co-dominant.	Scattered shrubs and dense grasses typically form the first two layers of vertical structure of this complex. A tree canopy provides a third layer when mesquite is present.	Located on highly erodable sands around downcutting desert washes. Also sometimes found on hillsides where sand has accumulated downwind and vegetation has been dispersed by birds.	Community may be found growing on flat ridges, low gradient slopes and among stabilized sand dunes in portions of the Mojave and Sonoran deserts. The only mapped occurrence of the community is located in the Sentinel Plain area.	Soils generally consist of sandy loam. These soils are well-drained.

TABLE 4-14
ECOLOGICAL CHARACTERISTICS OF BMGR NATURAL COMMUNITIES AS ASSESSED BY TNC

Natural Community Element	Composition	Structure	Function/Ecological Process	Physiographic Occurrence	Associated Soil Characteristics
Paloverde-Mixed Cacti-Mixed Scrub on Bajadas	Vegetation has a conspicuous but relatively sparse layer of saguaro cactus. A sparse to moderately dense short tree/tall shrub canopy is also present consisting of paloverde and creosotebush, along with ironwood and ocotillo in lesser prominence. A sparse herbaceous layer dominated by perennial grasses and forbs with seasonal annuals is present.	The dominant vegetation occurs in sparse to moderately dense woody layers of short shrubs, tall shrubs, and short trees, ranging from one-half to five meters tall. The herbaceous layer is generally sparse with scattered perennial grasses and forbs. The uppermost layer consists of a layer of large columnar cacti.	Linear xeroriparian systems occur nested within the community. Climate extremes may cause die-back of many plant species.	This community typically surrounds rocky slopes of low mountain ranges. The best example of this community on the BMGR occurs on the lower slopes and bajadas of the Sand Tank Mountains.	Soil generally consists of gravelly alluvium that is derived from basalt. Soil substrates are generally coarse-textured, shallow, gravelly clay loams. Caliche is a common characteristic.
Paloverde-Mixed Cacti-Mixed Scrub on Rocky Slopes	This community is of similar composition to that of the Paloverde-Mixed Cacti-Mixed Scrub on Bajadas, but contains additional associates such as *Opuntia bigelovia*.	This community is found along narrow drainages throughout large patches of sparse to clumped vegetative canopies. It generally occurs on highly irregular bedrock outcrops.	Linear xeroriparian systems are nested with the matrix of this community. Climate extremes may cause die-back of many plant species in this community.	This community is found throughout low mountain ranges, primarily above the major pediments. The best example on the BMGR occurs in the Sauceda Mountains.	This community occurs on highly irregular bedrock outcrops. Soils are generally of the Lithic Camborthids-Rock Outcrop-Lithic Haplargids Association, which are typically composed of very cobbly to cobbly loams, very stony to stony loams, gravelly very fine sandy loams, and rock outcrops. Soils of these mountains are subject to slight water erosion.
Sand Tank Mountains Uplands	Vegetation in this complex includes saguaro cactus and a sparse to moderately dense short tree/tall shrub canopy consisting of paloverde and creosotebush. Typical associates include crucifixion thorn and *Vaquelinea californica sonorensis*. Also present is a sparse herbaceous layer dominated by perennial grasses and forbs.	Large patches of a sparse to clumped vegetative canopy are found on steep, highly irregular bedrock outcrops. The structure is variable and influenced by aspect, edaphic characteristics, and sheltering cliffs and rocks.	Dynamic processes on landscapes dominated by this community involve linear xeroriparian systems that are nested within the larger community. Climate extremes may result in the periodic die-back of many plant species.	This community occurs at high elevations in and around the Sand Tank Mountains.	The community occurs on steep, rocky slopes. Soils of these mountains are subject to slight water erosion. They are comprised principally of the Lithic Camborthids-Rock Outcrop-Lithic Haplargids Association, which are generally very cobbly to cobbly loams, very stony to stony loams, gravelly very fine sandy loams, and rock outcrops.
Elephant Tree-Limberbush on Xeric Rocky Slopes	The composition of this community is similar to that of the Paloverde-Mixed Cacti-Mixed Scrub system, but is characterized by additional associates. Elephant tree, limberbush, *Nolina bigelovii*, and *Rhus kearnyi* are dominant in a mixed canopy. Vegetation of this system may differ with substrate.	This community forms large patches with a sparse to clumped vegetative canopy on highly irregular bedrock outcrops.	Linear xeroriparian systems are nested with the matrix of this community. Climate extremes may result in the periodic die-back of many plant species.	This community is found throughout low mountain ranges in the most arid portions of the Lower Colorado Valley and Arizona uplands of the Sonoran Desert. Mountain Xeroriparian Scrub is found throughout the large patch community along narrow drainages. Examples of this community occur in the Tinajas Altas and Gila Mountains	The community is commonly associated with granite bedrock and granite-derived gravels at the base of the mountains.
Desert Playa	Generally desert playas in the central Sonoran Desert are sparsely vegetated, with periodic emergence of ephemeral species. Large playas in the Sonoran Desert may have surrounding rings of vegetation. Characteristic vegetation differs between playas and unpredictable annuals may emerge.	Large patches are typically formed on flat plains and basins. Deep ravines may be formed as a result of drainage into the playas, but are subsequently filled in. Desert playas are often located within a matrix of Creosotebush-Bursage Desertscrub and may be associated with active and stabilized sand dunes.	Dominant ecological processes of desert playas are periodic flooding and subsequent evaporation. Large mud cracking at Las Playas may be related to volcanic activity.	Large open expanses that support playa lakes may also serve as sand sources for dunes located down-wind. Rainfall absorbed into dune fields may serve as a water source for seepage into the playa lakes. Many playas include dissected streambeds that are erased through time. Mohawk Playa is the best example on the BMGR.	Playas are typically associated with active and stabilized sand dunes.
Desert Tinaja/Spring	Tinajas are typically small aquatic ecosystems formed through water accumulation in bedrock depressions. Vegetation is typically absent or present as a few individual plants.	The community generally appears in the form of small patches among bedrock exposures.	The periodic inflow and slow evaporation are the primary processes that support tinajas. Tinajas may retain water permanently.	This community may occur in bedrock depressions throughout the desert southwest. Examples on the BMGR include Tinajas Altas and Bender Springs.	The community is commonly associated with bedrock depressions.

TABLE 4-14
ECOLOGICAL CHARACTERISTICS OF BMGR NATURAL COMMUNITIES AS ASSESSED BY TNC

Natural Community Element	Composition	Structure	Function/Ecological Process	Physiographic Occurrence	Associated Soil Characteristics
Salt Desertscrub	Two main types of saltbush communities occur. Saltbush communities found along major riverine systems typically have been converted to agriculture. The drier upland type is associated with creosotebush and numerous cactus species. The community is dominated by the xeromorphic shrub *Atriplex polycarpa*. The sparse to moderately dense graminoid layer may be dominated by warm season medium-tall and sort grasses. Forb cover is generally sparse.	This community may form large patches on desert bajadas. Vegetation typically has a sparse to moderately dense layer of shrubs up to two meters in height.	The dominant xeromorphic shrub *Atriplex polycarpa* is tolerant of saline or alkaline soils, and marks to extent of deep, fine loams soils of significant agricultural value. Periodic flooding, while infrequent, is tolerated by this community.	This community occurs on both upland and lowland sites throughout much of the arid and semi-arid western United States. Lowland sites include alluvial flats, drainage terraces, playas, washes, and interdunal basins while upland sites include bluffs and gentle to moderately steep sandy or rocky slopes. An example of this community occurs within the San Cristobal Valley.	Soils are variable with depths ranging from shallow to moderately deep and textures ranging from sands to loams to clay. Lowland sites may be moderately saline or alkaline.

Source: Hall and others 2001

TABLE 4-15
STATUS OF AND THREATS TO BMGR NATURAL COMMUNITIES AS ASSESSED BY TNC

Name	Historic and Current Distribution	Conservation Status	Purported Stressors	Purported Sources of Stress
Valley Bottom Floodplain Complex	The Valley Bottom Floodplain Complex is thought to have been common along the Arizona-Mexico border area and along the Gila River. Most natural communities have been lost to urban development and farmland. Intact examples remain within the BMGR, Cabeza Prieta NWR, Organ Pipe Cactus NM, and Tohono O'odham Nation.	The BMGR contains some of the best landscape-scale remaining examples of this community in Arizona and perhaps the entire Sonoran Desert. The community is fragile because the associated soils tend to be erodable and the level terrain makes it easily accessible to vehicles and human activities.	• Invasive plant species • Activities or events that alter overland floodflows • Soil compaction that negatively impacts water infiltration rates	• Fire (to the extent it opens a pathway for invasive plant species) • Legal and illegal roads • Bomb craters, or other surface disturbances that result in downcutting, which may then capture and reduce/eliminate sheet flow • Conversions to farmland (adjacent to BMGR) • Impoundments and drainage diversions • Livestock overuse (adjacent to BMGR)
Valley Xeroriparian Scrub	The Valley Xeroriparian Scrub occurs on mid to lower bajadas and along drainages in the Sonoran and Mojave deserts in southern California, southern Arizona, and the Mexican states of Baja California and Sonora. Past and current road development has directly altered the flow regime, composition, and structure of many examples.	This community is extremely important for wildlife, particularly migratory birds. Conservation goals should consider protecting an entire watershed and representing compositional differences that correspond to gradients of precipitation (from east to west) and watershed area.	• Altered hydrologic regimes • Altered vegetation composition • Reduced tree density	• Legal and illegal roads • Woodcutting (especially of ironwood)
Mountain Xeroriparian Scrub	This community typically occurs on upper bajadas and low- to moderate-elevation mountain slopes in the Sonoran and Mojave deserts. Most examples remain within their presumed historic range.	Conservation goals should consider representing compositional differences that are likely to correspond to gradients of aspect and precipitation (from east to west).	• None noted.	• None noted.
Dune Complex and Dune Endemics	This community is scattered throughout the Sonoran and Mojave desert ecoregions. The BMGR includes two distinct large dune complexes: Mohawk Dunes and portions of the Gran Desierto at Yuma Dunes.	Conservation goals should include representing the compositional variation between these large dune complexes. Most dune systems elsewhere in the Sonoran Desert ecoregion are threatened by recreational off-road vehicle use.	• Disturbances that displace native vegetation and endemic wildlife • Disruption of natural dune dynamics • Invasive species	• Illicit and military off-road vehicle use, which eliminates perennial vegetation • Livestock and their pathways • Undocumented aliens and illegal drug smugglers
Creosotebush-Bursage Desertscrub	This desertscrub community is widespread across the Mojave and Sonoran desert ecoregions on mesas, plains, valleys, bajadas, and low hills. Similar communities occur in the Chihuahuan Desert.	It is recommended that large blocks of this community be protected from intensive land uses to protect soil crusts, especially in the most arid, western portions of the BMGR. Representative, well-protected examples are needed for long-term monitoring.	• Excessive soil erosion • Displacement of native flora/fauna • Invasive species	• Roads and livestock grazing (historic) which could provide entry corridors for invasive species • Erosion and entrenchment of soils • Off-road vehicle traffic (including military operations) causing collapse of rodent mounds
Creosotebush-Big Galleta Scrub	The distribution of this community may be found in portions of the Mojave and Sonoran deserts and in a number of locations throughout the border area. It is widely distributed throughout the Yuma Desert. The community may have been more prevalent before livestock grazing converted much of it to Creosotebush-Bursage Desertscrub. Farmland and urban development have likely contributed to its conversion.	This community is important for soil stability and erosion prevention, particularly in xeroriparian areas. Big galleta is adversely impacted by livestock grazing, so the lack of grazing pressure on the BMGR would eliminate overstocking and poor grazing management practices that have occurred throughout most of the areas.	• Excessive soil erosion • Displacement of native flora/fauna • Destabilization of the erodable soils	• Legal and illegal roads, and associated vehicle traffic that could cause soil erosion and be associated with the spread of invasive plants • Livestock grazing (historic) and feral burros that have removed native species or acted as vectors for invasive plant species
Paloverde-Mixed Cacti-Mixed Scrub on Bajadas	This community is endemic to the Sonoran Desert in southern Arizona, southeastern California, and adjacent Sonora and Baja Norte, Mexico, and occurs on hillsides and mesas in southern Arizona and southeastern California. Much of the historic range of this system has been lost due to human activities in the accessible bajadas. Overgrazing may have led to loss of species and soils in some areas.	The BMGR presents the only large, unfragmented example of this community in the entire Sonoran Desert. This community is vulnerable throughout the ecoregion due to the accessibility of the bajadas. Conservation efforts should focus on protection of the variation in this community across the full ecological gradient of its distribution as a buffer against climate extremes, which may result in the death of many plant species. Pronghorn may be seasonally dependent on the chain fruit cholla found within this community.	• Displacement of native vegetation • Soil erosion • Alteration of the natural water regime	• Roads that could potentially serve as corridors for invasive species and cause soil entrenchment and erosion • Historic livestock grazing • Invasive species • Illegal collection of cacti • Fire • On-the-ground military activities

TABLE 4-15
STATUS OF AND THREATS TO BMGR NATURAL COMMUNITIES AS ASSESSED BY TNC

Name	Historic and Current Distribution	Conservation Status	Purported Stressors	Purported Sources of Stress
Paloverde-Mixed Cacti-Mixed Scrub on Rocky Slopes	This community is endemic to the Sonoran Desert ecoregion. Distribution is limited to low mountain ranges throughout the Lower Colorado Valley and Arizona Uplands subdivisions. This community is widespread on the upper bajadas on the BMGR, extending east from and including the Mohawk Mountains to the Sand Tank Mountains. Some of the historic range of this community has been lost to urban expansion into the foothills of the mountains surrounding Tucson and Phoenix.	Conservation efforts should focus on protection of this community because its presence is important for watershed protection. This community is relatively isolated and inaccessible and is not considered to be significantly threatened. However, some areas are potentially threatened by recreation and cacti collectors.	• Altered vegetation composition	• Potentially vulnerable to recreationists and professional cacti collectors
Sand Tank Mountains Uplands	Although endemic to the Sonoran Desert ecoregion, the distribution of this community is limited to the Sand Tank Mountains above the pediments; however, similar expressions of this community may occur in the Ajo Mountains to the south.	This community is an extremely rare and vulnerable community that contains species more typical of woodland/chaparral communities from the Pleistocene.	• Altered vegetation composition and structure	• Potentially vulnerable to recreationists and professional cacti collectors • Invasive species • Climate change
Elephant Tree-Limberbush on Xeric Rocky Slopes	This community is endemic to the Sonoran Desert ecoregion. Distribution is limited to low mountain ranges in limited portions of the Lower Colorado Valley, Arizona Uplands, and Central Gulf Coast subdivisions. This community is found in the western extreme of the BMGR in the Copper Mountains, southern Gila Mountains, and northern Tinajas Altas Mountains.	The BMGR and Cabeza Prieta NWR contain the only representations of this community in the United States. On the BMGR this community is not impacted by any military training activities.	• Altered vegetation composition • Soil erosion	• Recreational use
Desert Playa	Desert playas similar to those found at BMGR may occur in the Mojave and Sonoran deserts, but few are found in the Sonoran Desert.	Playas are important as seasonal, temporary water sources used by many animal and plant species. Playas are critical resources that should be protected within a watershed context.	• Hydrological disruption causing alteration of vegetative composition	• Creation of rock dams south of BMGR (in Mexico) producing hydrological changes that could affect endemic biota
Desert Tinaja/Spring	Tinajas, or small aquatic ecosystems much like them, may occur throughout the desert southwest.	Because Tinajas on the BMGR are important as a source of water for desert wildlife, this community is essential in the life cycles of many amphibians and invertebrates and as feeding and drinking areas for bats and other wildlife. Some invertebrates endemic to desert tinajas may exist on the BMGR, but more sampling is needed for this to be determined.	• Little is known	• Alteration of tinajas could potentially cause detrimental effects
Salt Desertscrub	A variety of salt desertscrub communities occur in arid and semi-arid areas throughout the southwestern U.S. and into Chihuahua, Mexico. They also are found in the western Great Plains to the Great Basin, from western Kansas, Colorado, and Wyoming to Utah, Nevada and eastern Oregon. These communities are considered good forage for deer and many classes of livestock because they are highly nutritious and palatable and because much of the historic range of these communities have been lost or disturbed due to grazing pressures.	Most stands of this community have been lost in the Sonoran Desert due to conversion to agriculture and use for domestic livestock grazing. Because of grazing restrictions on the BMGR, it could be essential in the conservation of this community. The areas where this community may be found on the BMGR are not well known. These communities need to be found, assessed, and protected.	• Altered vegetation composition and dynamics	• Past conversion to agriculture and grazing (adjacent to the BMGR)

Source: Hall and others 2001

In contrast to training impacts, the military withdrawal status protects much more vegetation than the amount impacted by training. The vegetation in the remaining 90 percent of the range has remained relatively undisturbed, in large part because the withdrawal status prohibits incompatible surface disturbing activities such as mining, livestock grazing, and intensive recreation.

Other impacts include the change in vegetation patterns that result from the development of roads needed to meet military mission requirements on the BMGR. What is commonly referred to as the "road effect" is the result of water washing off of roadways and into roadside ditches, creating an ideal location for seedlings and water to accumulate. When roadways disrupt washes or other natural drainages, water flow can be dammed and temporarily pooled, which can make this effect more prominent. A related concern from a resource management perspective, is the potential for these roadways to provide an unintended pathway for non-native plant species to be introduced and distributed within the BMGR. Although not the case throughout the BMGR, formerly used roads in various locations display levels of recovery including dense coverage with bursage and mesquite trees propagated in roadside ditches overtaking the former road surface. Similarly, varying levels of vegetative recovery have been noted at former target, test, and training sites on the BMGR as well.

Existing vegetation management at developed sites such as the Gila Bend AFAF and Marine Corps Cannon Air Defense complex are addressed in Section 4.9.

4.5.2.1 Species Conservation Elements

TNC identified species conservation elements, which resulted in one plant selected as a conservation element—crucifixion thorn. Crucifixion thorn is an endemic species that occurs in fine, loamy, floodplain-type soils and may at times be locally common. This species may be in decline because of low levels of seedling establishment and poor growth/reproduction (Turner and others 1995). Although this species does not correspond to a particular natural community, the Valley Bottom Floodplain Complex may be particularly important for crucifixion thorn.

Stands of crucifixion thorn have been located on the BMGR, west of the Mohawk Dunes and along the margins of the Mohawk Playa, just east of the dunes. It may also occur in the center of valley bottoms west of the Sand Tank and Sauceda mountains and within the Valley Bottom Floodplain Complex communities in the San Cristobal Valley.

4.5.3 Existing Regulatory and Statutory Requirements and Management Plans and Actions

4.5.3.1 Regulatory and Statutory Requirements

As outlined in Section 1.2 and Table 1-1, three agencies have primary responsibility for natural resources, and thus management of vegetation resources, on the BMGR—the Air Force, Navy/Marine Corps, and the AGFD. Per the MLWA of 1999, the Secretary of the Interior is accorded a process whereby he can transfer management authority if he certifies that the Air Force and/or Navy are not managing the land in accordance with the INRMP and that such failure will cause significant degradation, and the DoD response to the alleged mismanagement does not satisfy the Secretary of the Interior.

Many of the regulatory and statutory requirements that relate to general vegetation pertain primarily to protected species and are discussed in Section 4.7.3. Those that may be more applicable to general vegetation are as follows:

- **Executive Order 13112, *Invasive Species.*** Requires federal agencies to identify actions that may affect invasive species, use relevant programs to prevent introduction of invasive species; detect, respond, and control such species; monitor invasive species populations; provide for restoration of native species; conduct research on invasive species; and promote public education.

- **DoD Instruction 4715.3, *Environmental Conservation Program.*** Outlines DoD policy for the management of natural resources and the preparation of INRMPs. The most applicable provisions with regard to vegetation are those requirements to manage natural resources to support and be consistent with the military mission, while protecting and enhancing those resources for multiple use, sustainable yield, and biological integrity; to base land use practices and decisions on scientifically sound conservation procedures and techniques, and use scientific methods and an ecosystem approach; to incorporate the principles of ecosystem management in INRMPs; to inventory, manage, and protect biologically or geographically significant or sensitive natural resources or species; and to promote biodiversity.

- **Fish and Wildlife Conservation Act of 1980.** Promotes state programs to conserve, restore, and benefit habitat.

- **Title 17 of the Arizona Revised Statutes, Game and Fish.** Primarily addresses wildlife, but applicable for vegetation in terms of habitat protection provisions (see Section 4.6.3)

- **Arizona Administrative Code Rules, Title 12, Natural Resources, Chapter 4, Game and Fish Commission.** Under the authority of A.R.S. § 17-201 et. seq., establishes detailed rules for licenses and permits, taking and handling of wildlife, live wildlife, heritage grants, and wildlife areas among others.

4.5.3.2 Management Plans and Actions

Goldwater Amendment

The MLWA of 1986 assigned BLM the responsibility for land and natural resource management on the range. The Goldwater Amendment provides general guidance for the protection of vegetation. It states that high priority will be given to protecting vegetation from disturbances during land-based activities. Under the amendment, botanical communities occurring on the BMGR, including dune communities, receive increased protection by the designation of ACECs and other management areas and implementation of specific management actions (see Section 4.11 for more details regarding these special management areas). The specific management actions for general botanical resources contained in the Goldwater Amendment are as follows:

1. Give high priority to protecting vegetation from disturbances during any land-based activities
2. Conduct floristic surveys and monitoring for populations of sensitive, candidate, threatened, endangered, rare, or unique species
3. Utilize any newly gathered botanical information to update the vegetation map developed for the 1986 Natural Resources Management Plan for Luke Air Force Range
4. Enter all existing and new botanical information into its existing database to be used in future resource recommendations

Habitat Management Plans

The Lechuguilla-Mohawk HMP includes two relevant management actions related to general vegetation: (1) determine the current distribution and rate of spread of Sahara mustard within the HMP area by mapping where it is currently found and (2) inventory the Lechuguilla-Mohawk HMP area for special status plants. To date, four Sahara mustard monitoring plots have been established, but no conclusions have been reached about the distribution and spread of the species or what effect, if any, this plant is having on populations of native plants. No comprehensive special status plant inventory has been accomplished.

The Draft Barry M. Goldwater East HMP calls for Acuña cactus and dune-endemic plant surveys.

4.5.3.3 Botanical Surveys

No complete survey of the botanical resources of the BMGR has been done. The Cabeza Prieta NWR had a flora survey published in 1966 (Simmons 1966). Organ Pipe Cactus NM had a flora survey published in 1980 (Bowers 1980) and a checklist in 1985 (Anonymous 1985). The Luke Air Force Range Natural Resources Management Plan contains a list of flora at the BMGR and Cabeza Prieta NWR that was compiled from published and unpublished records. That list contains 417 taxa (U.S. Air Force 1986) and is the basis of the current list of BMGR plants (Appendix D, Table D-1) including the Cabeza Prieta NWR. The actual number of species of plants present on the BMGR is likely to be higher. A 1998 checklist of the plants on the Cabeza Prieta NWR includes 391 species (Felger 1998). The Checklist of Flora of Organ Pipe Cactus NM lists 522 taxa, and an additional 30 or so had been recorded by 1990 (Felger 1990).

Most of the recent plant efforts have been focused on surveys for protected or rare species. However, the following studies have focused on other aspects of general vegetation:

- ***Long-term Vegetative Changes Photography.*** From 1994 to 1996, 64 photo points were established to provide a baseline for documenting long-term vegetative changes (Dames & Moore 1997a). Photo points were established on select active range areas and in control areas throughout BMGR—East to monitor long-term changes in vegetation in both military use areas and in control areas. Photos were taken in each of the four cardinal directions each year and vegetative changes were documented. It was recommended that these photo points be re-evaluated every five to ten years to evaluate long-term vegetative change.

- ***Plant Surveys at the Mohawk Dunes.*** Three relatively recent surveys of flora at the Mohawk Dunes have been accomplished. Turner and others (1997) completed an inventory of plants on the Mohawk Sand Dunes and developed a plan for long-term monitoring of this sensitive ecosystem. Eighty-four plant species were found growing in or near the Mohawk Dunes. Two dune endemics of special interest were found growing in the Mohawk Dunes: Schott's wire lettuce and Spanish needles. In a later survey (Dames & Moore 1996), an abundance of Schott's wire lettuce was recorded in a wet spring, with densities exceeding one plant per square meter in places. No giant Spanish needles were found during the inventory and monitoring of the sand dune ecosystem at BMGR. However, the lack of observations may or may not indicate absence of the species on the dunes of the BMGR. Felger and others (1998) conducted a survey of the flora of the Mohawk Dunes area and identified 120 species in 35 families. This study found that one characteristic that sets the Mohawk Dunes apart from the other Sonoran Desert dune areas is their comparative lack of endemic dune species. The Mohawk Dunes has very few species with morphological adaptations to moving sand, probably due to their lack of and isolation from large, actively moving sand fields.

- ***Vegetation Sampling in North and South TAC.*** Dames & Moore (1999a) conducted vegetation sampling on North and South TAC in relation to locations of Sonoran pronghorn. Species lists compiled included perennial plants on both ranges and herbaceous plants on North TAC at pronghorn locations and random points.

- ***Mapping of Sonoran Pronghorn Habitat.*** As part of the recovery actions identified by the Sonoran Pronghorn Recovery Team, the University of Arizona is currently in the fieldwork stage of investigating preferred Sonoran pronghorn forage species and preparing a vegetation association map for Sonoran pronghorn habitat within Organ Pipe Cactus NM, BLM lands, Cabeza Prieta NWR, and the BMGR. The objectives of this study partially fulfill recovery action 1.5.2 from the 1998 Sonoran Pronghorn Recovery Plan (USFWS 1998a and 2001a, Morgart 2002c).

4.5.3.4 Exotic, Invasive, or Noxious Species Survey, Control, and Monitoring

As defined in DoD Instruction 4715.3, exotic plants are "species that occur in a given place, area, or region as the result of direct or indirect, deliberate or accidental introduction of the species by human activity." Executive Order 13112 requires federal agencies to identify actions that may affect invasive species; use relevant programs to prevent introduction of invasive species; detect, respond and control such species; monitor invasive species populations; provide for restoration of native species; conduct research on invasive species; and promote public education. An invasive species, as defined in Executive Order 13112, is "an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health." The term noxious, as defined in the Federal Noxious Weed Control Act, "is any living stage of a parasitic or other plant of a kind which is of foreign origin; is new to or not widely prevalent in the United States; and can directly or indirectly injure crops, other useful plants, livestock, poultry or other interests of agriculture, including irrigation, navigation, fish and wildlife resources, or the public health."

Exotic, invasive, or noxious plants are all generally characterized by their ability to colonize severely disturbed areas, their absence from undisturbed habitats, and their ease of dispersal. Roads, livestock grazing (current grazing near the BMGR perimeter and historic grazing within the BMGR), and people are the primary vectors for invasive species on the BMGR. BMGR—East may have a comparatively greater distribution of invasive species than BMGR—West because of higher annual rainfall amounts and closer proximity to vector sources for invasive species (Hall and others 2001).

The density and distribution of non-native species on the BMGR is not accurately known. In nearby Organ Pipe Cactus NM, between five and ten percent of the species are estimated exotics (Felger 1990). The most widespread of those recorded on the BMGR is the Sahara mustard,

which is found in sandy soils throughout the BMGR. Salt cedar has been observed in some areas of the range, including along the wash adjacent to Stoval Auxiliary Airfield (Rankin and Wirt, personal observation 2000). Another species that is spreading rapidly, especially in the Crater Range, is buffelgrass. Other non-native grasses include: Lehmann lovegrass, red brome, and Mediterranean grass (U.S. Air Force 1999).

Turner and others (1997) found three non-native plant species—Mediterranean grass was noted to occur throughout the survey area (with the exception of the dune crests), Sahara mustard was noted as highly distributed (with high plant densities only present at the north end of the dunes), and a single salt cedar plant (which was apparently eliminated). A more recent survey of the distribution of Sahara mustard in the Mohawk Mountains and Sand Dunes in February and March 2001 by Malusa and others (2001) found that 80 to 90 percent of the Mohawk Dunes in both the Mohawk Valley and San Cristobal Valley were host to Sahara mustard, with only the southernmost portion of the dunes uncolonized. Malusa and others (2001) report that roads in the vicinity of the dunes, which are principally used by the Border Patrol to meet mission requirements but are also used by the public, are the main vectors of dispersal for Sahara mustard. Roads alter drainage patterns and catch water to support Sahara mustard growth, and can provide preferred conditions for germination of this species by burying the seeds (particularly with the use of tire drags to smooth road surfaces on roads use by the Border Patrol along the border for surveillance for undocumented aliens). Additionally, seeds may collect in wheel wells or other vehicle parts and then, as vehicles are driven along roads, the seeds may be dispersed.

Cooperative Weed Management Areas

A Steering Committee of the BEC was established in late 2001 to develop an umbrella council that would incorporate broad guidelines and assist in facilitation and exchange of information regarding invasive species management. Two preliminary Cooperative Weed Management Areas have been established: a northern section that extends from the northern edge of the BLM Yuma office land management areas and includes Yuma Proving Ground, and Kofa NWR, and west to the Imperial NWR, and a southern section that includes the BMGR, Sonoran Desert NM, Organ Pipe Cactus NM, and Cabeza Prieta NWR. A five year strategic plan will be developed at the council level to identify specific items to be addressed collectively, such as education and training. The Steering Committee will also develop annual plans at the management implementation level. Funding management has not yet been identified. Cooperation with ADOT in the management of the State Route 85 corridor has been initially identified as a critical component of the effort (Faltisco 2002a).

4.5.3.5 Woodcutting and Gathering

The Goldwater Amendment addresses woodcutting and gathering on the BMGR. According to the plan amendment, no wood cutting permits are issued for BMGR lands. Campfires are permitted on BMGR lands using dead or downed wood. All firewood collection within ACECs and within 150 feet of the Camino del Diablo Backcountry Byway is prohibited. BLM Yuma Field Office restricts collection of ironwood to three pieces, up to ten pounds, and the Phoenix Field Offices rules could be interpreted to allow the taking of a "reasonable amount, not to exceed what one could carry in the arms in one trip" (Dahlem 2002a).

Vegetation denudation has been reported in some areas of the BMGR like the Davis Plain and along the international border. Other areas of the BMGR are likewise susceptible to over-utilization of wood and plant materials. Exploitation of leguminous trees, especially ironwood, for firewood, charcoal, and woodcarving has been documented along the U.S.-Mexico border, even within the supposed protected area of Organ Pipe Cactus NM. Exploitation of these trees is detrimental to the tree itself, to the structure of the plant community in which they occur, and, to species that are dependent on nurse plants (e.g., ironwood) for their establishment (Suzán and others 1997, 1999). The Lechuguilla-Mohawk HMP calls for photo monitoring in washes near roads and away from roads in order to assess the accumulation/removal of dead and downed wood and cautions that more intensive law enforcement may be needed in some areas. However, such programs have not been implemented.

4.5.4 Information Not Currently Available to Support Vegetation Resource Management

The current lack of some existing data or information poses potential challenges for the future management of general vegetation resources within the BMGR. This currently unavailable information was identified during the preparation of the affected environment section of this EIS. It does not constitute incomplete or unavailable information needed to conduct the environmental impact analysis presented in Chapter 5 in accordance with 40 CFR §1502.22. Although additional vegetation resources information needs may be defined in the future, those identified in this document include:

- Hall and others (2001) identify the following information as needed to provide currently unavailable understandings of the ecological characteristics of natural community conservation elements within the BMGR:

    - Valley Bottom Floodplain Complex: natural flow regimes; effects of roads (both within the delineated community boundary and immediate watershed) on function; effects of invasive plants and control measures on composition

- Valley Xeroriparian Scrub: natural flow regimes; effects of invasive plants and control measures on composition; effects of roads on function; effects of recreational and undocumented alien activities on composition and structure

- Mountain Xeroriparian Scrub: natural flow regimes; effects of invasive plants and control measures on composition; effects of recreational and UDA activities on composition and structure

- Dune Complex and Dune Endemics: sand source-sink dynamics; effects of invasive plants and control measures on composition, structure, and function

- Creosotebush-Bursage Desertscrub: cryptobiotic soil crust community structure and function; effects of invasive plants and control measures on composition, structure, and function; restoration strategies

- Creosotebush-Big Galleta Scrub: effects of invasive plants and control measures on composition, structure, and function; restoration strategies

- Paloverde-Mixed Cacti-Mixed Scrub on Bajadas: effects of invasive plants and control measures on composition, structure, and function

- Paloverde-Mixed Cacti-Mixed Scrub on Rocky Slopes: potential effects of climate change on species composition

- Sand Tank Mountains Uplands: potential effects of climate change on species composition

- Elephant Tree-Limberbush on Xeric Rocky Slopes: potential effects of climate change on species composition

- Desert Playa: hydrological dynamics (local and watershed); importance of playas to fauna; effect of invasive plants and control measures on composition, structure, and function; effects of roads on function

- Desert Tinaja/Spring: hydrological dynamics; importance of tinajas to fauna, particularly invertebrates

- *Natural Community Occurrences and Descriptions.* Hall and others (2001) identify the following information as needed to provide refined data on the site-specific occurrences and composition/structure of natural community conservation elements within the BMGR:

- Valley Bottom Floodplain Complex: confirmed occurrences and description
- Creosotebush-Big Galleta Scrub: confirmed occurrences and description
- Sand Tank Mountains Uplands: description
- Elephant Tree-Limberbush on Xeric Rocky Slopes: confirmed occurrences and description
- Desert Tinaja/Spring: occurrences
- Salt Desertscrub: confirmed occurrences and description.
- All Other Natural Community Conservation Elements: an overall ground-truthing of the distribution of natural community occurrences and by descriptions of major associations of plant communities contained within each natural community

- *Impacts of Human Activities.* Information on the effects of past and present human activities—including recreation, firewood collection, road and vehicle usage, existing mines, water development, and UDA traffic—on vegetative community composition, structure, and/or function is limited to macro-level observations and estimates. There is also a scarcity of data on the degree to which various communities can sustain human-caused disturbance (soil compaction, erosion, spread of non-native species, direct vegetation damage or loss). Sufficient data on these potential effects are available to support the macro-level resource management planning being addressed in this EIS, but additional data may be needed for planning effective site-specific resource management actions.

- *Crucifixion Thorn.* Hall and others (2001) report that there is no information currently available that defines the factors that affect the occurrence and abundance of crucifixion thorn within the BMGR.

- *Desert Tree Caper.* Desert tree caper (*Atamisquea emarginata)* and *Stegnosperma halimifolium* are important host plants for invertebrates. Desert tree caper is the only host plant for Howarth's white butterfly and *S. halimifolium* might function as a host plant keystone species for a variety of pollinator species. Hall and others (2001) report that the only known population of desert tree caper within the BMGR region occurs on Organ Pipe Cactus NM. Both species of desert tree caper may also be present on the BMGR but, if so, their current distributions and abundances are not known.

- *Firewood.* Down and dead wood is a limited but important habitat component within the BMGR. Although available observational information does not indicate that down and

dead wood is being depleted at an excessive rate, there are no currently available qualified data defining the abundance of this resource or the rates at which it is being consumed as firewood for recreational purposes.

4.6 GENERAL WILDLIFE AND WILDLIFE HABITATS

4.6.1 Existing Conditions

4.6.1.1 Ecoregional Context

The Sonoran Desert region has a great variety of wildlife species and habitats. Habitats range from extremely hot, arid desert to semiarid, tropical forest, to frigid subalpine meadows. There are an estimated 60 species of mammals, more than 350 species of birds, about 100 reptiles, and some 30 freshwater fish native to the Sonoran Desert (Phillips and Comus 2000).

These endemic wildlife species depend on the Sonoran desertscrub biotic communities and have adapted various strategies for coping with temperature extremes and limited water. Many species avoid high temperatures by being most active at night or during dusk or dawn. Burrowing animals avoid the heat in cool microclimates while large mammals, such as bighorn sheep and mule deer, seek shady spots during the day and remain inactive. Some species, such as the birds and jackrabbits, radiate heat while other species, such as coyotes and vultures, have adapted methods of evaporative cooling. Although some species (such as kangaroo rats, elf owls, and kit foxes) are highly adapted to life in the absence of free-standing water (getting needed moisture primarily from dietary intake), other desert dwellers (such as coyotes, mule deer, and bighorn sheep) require periodic open water. Thus, their home ranges revolve around water holes (Phillips and Comus 2000).

While continued population growth and urban expansion in Arizona pose real and immediate threats to many Sonoran desertscrub species, the biological health of the BMGR is considered to be very good. A strong indicator of this is that all of the wildlife species believed to be present in 1941 when military use began are still found on the range today, likely in the same relative numbers as in 1941. As a result of the mostly east-west orientation of its boundaries, its extensive length along this orientation, and the amount and variety of its topographic relief, the BMGR's landscape and associated biota experience a wide range of environmental variation in precipitation and temperature typical of the Sonoran Desert as a whole, but expressed at a smaller geographic scale. Because the BMGR captures a large range in the variation of a number of environmental variables, it potentially captures corresponding natural variation in composition, structure, and function of its biotic communities (Felger and others 1997).

There are two Sonoran Desert biotic communities present on the BMGR, the Lower Colorado River Sonoran Desertscrub, which primarily occurs within BMGR—West and western portions

of BMGR—East, and Arizona Upland Sonoran Desertscrub, which occurs within the eastern portions of BMGR—East (Brown and Lowe 1994). The variation in rainfall amounts and vegetation density and distribution from east to west, has correlating influences in animal density and distribution. Some vertebrate species are found only, or almost exclusively, in BMGR—East. These include javelina, antelope jack rabbit, rock squirrel, white-tailed deer, mule deer, Harris hawk, curve-billed thrasher, crissal thrasher, Bell's vireo, Lucy's warbler, pyrrhuloxia, and brown towhee. A few species, such as the Cowles fringe-toed lizard and the flat-tailed horned lizard are found exclusively on BMGR—West. Xeroriparian washes, which are estimated to occupy less than five percent of the Lower Colorado River Valley Subdivision, support 90 percent of its bird species (Phillips and Comus 2000).

4.6.1.2 Wildlife Habitats

Because of their diversity, wildlife species occur in virtually all portions of the BMGR environment. Some species of wildlife utilize a variety of habitats, while others are restricted to one particular habitat. While the natural communities detailed in Section 4.5 are generally synonymous with wildlife habitat, they may be more generally viewed as follows for the purposes of this discussion:

- ***Creosotebush Desertscrub Habitats***—includes Creosotebush-Bursage Desertscrub, Creosotebush-Big Galleta Scrub, and Salt Desertscrub Natural Communities

- ***Desert Riparian Habitats***—includes Valley Bottom Floodplain Complex, Valley Xeroriparian Scrub, and Mountain Xeroriparian Scrub Natural Communities

- ***Mixed Sonoran Desertscrub Habitats***—includes Paloverde-Mixed Cacti-Mixed Scrub on Bajadas, Paloverde-Mixed Cacti-Mixed Scrub on Rocky Slopes, Elephant Tree-Limberbush on Xeric Rocky Slopes, and Sand Tank Mountains Uplands Natural Communities

- ***Sand Dune Habitats***—includes the Dune Complex and Dune Endemics Natural Community

- ***Open Water Habitats***—includes the Desert Tinaja/Spring and Desert Playa Natural Communities

Creosotebush Desertscrub Habitats

Creosotebush desertscrub areas occur below the basal contour of mountain ranges and associated foothills and rocky outcrops not including major drainages (i.e., xeroriparian areas). These lowland areas are floristically characterized by associations of creosotebush and white bursage. Reichenbacher and Duncan (1989) estimate that the creosotebush-white bursage association occupies about three-fourths of the non-mountainous terrain of BMGR—West, especially where soils are proportionately high in silt and clay composition such as the lower valley floors along the northern edge of the range. Other commonly associated plant species include little-leaved ratany, cholla, thornbush, brittlebush, ocotillo, ironwood, paloverde, and saguaro (U.S. Marine Corps 1997).

Wildlife species generally respond to changes in vegetative cover and soil conditions within lowland habitats. Many rodent species tend to occur in the greatest density and diversity in locations that have dense stands of creosotebush scrub and usually decrease in sparse cover. Creosotebush habitats with deep soils are characterized by many burrows at the base of plants, under the canopy of the vegetation. These areas contain fossorial (burrowing) species including the Arizona pocket mouse, Merriam's kangaroo rat, kit fox, badger, and many species of reptiles. Soil substrate is probably a much more important limiting factor in the distribution and density of fossorial mammalian and reptilian species than is the density of creosotebush and associated shrubs. Burrowing species require friable soils and their density and diversity characteristically decline in rockier habitats.

Creosotebush habitats are notably lacking in birds (Turner and Brown 1982), although black-throated sparrows and lesser nighthawks breed in these habitats on BMGR—West (Gilbert 1996). The abundance of rodents inhabiting these areas attracts a variety of predators such as raptors and coyotes. Sonoran pronghorn use this habitat for forage, particularly during the spring (U.S. Air Force 1986).

Desert Riparian Habitats

From the standpoint of wildlife diversity, xeroriparian scrub habitats probably support the most species on the BMGR by providing abundant food, cover, and relatively more water for wildlife than any other habitat type. Wildlife, especially birds, large mammals, and invertebrates, make disproportionate use of the resources within this habitat when compared with surrounding communities. The relatively dense vegetation provides forage, cover, nest sites, and perches, which are scarce in the bordering sparsely vegetated habitats. Quantities of organic material are relatively high within xeroriparian communities, providing an important source of nutrients for both plants and animals. Additionally, organic material in the form of litter may provide cover and nesting material resources for some animals (Hall and others 2001).

This habitat type supports more nesting bird species than any other on the BMGR and represents an important resource for migrating birds. The flowering of paloverde, mesquite, and ironwood corresponds with the greatest flux of migrating songbirds during spring migration. These flowering events support a rich insect fauna, which provide forage for a variety of migrating birds and bats (U.S. Marine Corps 1997; Morrison and others 1997; and Johnson and Haight 1985).

These habitats are also extremely important to some year-round resident wildlife species. Larger mammalian species, such as desert mule deer, depend on these habitats for forage, shade, movement corridors, and cover for critical life history events such as fawning. Smaller mammals forage on the seeds produced by the microphyllous trees and others forage on greens and/or collect seeds from the relatively rich ephemeral flora associated with the xeroriparian communities. Some insectivorous species, such as the California leaf-nosed bats, which do not hibernate nor migrate, also use these habitats for perennial forage. Many reptile species occur in xeroriparian scrub where forage (such as insects, fruits, green plants, and lizards) is plentiful (Hall and others 2001; U.S. Air Force 1986; and U.S. Marine Corps 1997).

Mixed Sonoran Desertscrub Habitats

Mixed Sonoran desertscrub habitat areas are upland areas floristically dominated by a mix of plant species that are characteristic of the Arizona Upland and Lower Colorado River Valley subdivisions of the Sonoran Desert. Characteristic plant species include foothill paloverde, saguaro, several other cacti, elephant tree, and Sangre-de-Cristo as well as agaves. In the eastern portions of the BMGR, upland habitats support a vegetation type that is more characteristic of the Arizona Upland Subdivision, but still largely ecotonal (a transition zone) with the Lower Colorado River Valley Subdivision. Species such as foothill paloverde and saguaro are more common in upland habitats on this part of the range than in the western portions (U.S. Marine Corps 1997).

Wildlife in these upland habitats includes mountain lion, coyote, black-tailed jack rabbit, desert tortoise (Sonoran population), and various species of lizards and snakes. Wildlife seeking water is often found in this habitat because many of the water sources are located here. Accordingly, desert bighorn sheep and mule deer often concentrate near these water sources during periods of drought. Caves, crevices, and abandoned mine shafts in this habitat type provide roosting and nursery colony sites for many of the resident bat species listed in Appendix D, Table D-2. This habitat also supports those reptiles (such as the common collared lizard) that are not adapted to sandier areas (U.S. Air Force 1986; U.S. Marine Corps 1997).

Sand Dune Habitats

Aeolian dunes exist on the BMGR on the west side of the Mohawk Mountains and as an extension of the Gran Desierto that reaches into the United States from the Republic of Mexico. In addition to these two major sand dune systems, there are many locales with minor, largely consolidated dune systems (U.S. Marine Corps 1997).

Dunes and/or adjacent consolidated areas of fine, sandy soils are inhabited by a number of vertebrate species. The mammalian fauna of sand dune systems is not particularly different from that present in other habitats. Most mammals present are small, nocturnal rodents that are highly adapted to life in the virtual absence of free water such as pocket mice and kangaroo rats. Other mammals that are likely to be found in or near dune systems include rabbits and hares, ground squirrels, wood rats, grasshopper mice, coyotes, Sonoran pronghorns, and kit foxes (U.S. Marine Corps 1997).

No bird species are uniquely characteristic of sand dune habitats. Species likely to be encountered on the BMGR in or near sand dune systems include horned larks, loggerhead shrikes, LeConte's thrashers, mockingbirds, black-tailed gnatcatchers, and black-throated sparrows. Among the vertebrates, some species of reptiles are the most uniquely adapted to life in sand dune systems. Unique reptilian adaptations for existence in fine, sandy habitats include countersunk lower jaws, well-developed ear flaps, and fringe-like scales on the toes, which are all adaptations for burrowing in the sand or moving quickly across the surface. Reptile species likely to be present include large-spotted leopard lizard, flat-tailed horned lizard, Cowles fringe-toed lizard, banded sand snake, western shovel-nosed snake, spotted leaf-nosed snake, western ground snake, and sidewinder. The flat-tailed horned lizard is found near dune systems west of the Gila Mountains. The Cowles fringe-toed lizard is limited to dune habitats (U.S. Marine Corps 1997).

Open Water Habitats

This habitat type is restricted to managed and natural tanks (tinajas), charcos, playas, ephemeral washes, and roadbeds that may flood during heavy rains. They are important as seasonal, temporary water sources on which many vertebrate and invertebrate species depend. These areas provide water for bighorn sheep, deer, Sonoran pronghorn, coyote, and various other mammals including migrant shorebirds and waterfowl. Tinajas, washes, and playas that hold water long enough for complete metamorphosis are critical for the survival of Couch's spadefoot and other true toads (U.S. Air Force 1986). Great Plains toads, not uncommon in the Sonoran Desert, have been observed at the Mohawk Dunes. It is thought that these Great Plains toads are associated with Mohawk Playa (which is located east of the dunes and is the only known landscape feature that might hold water sufficiently long and that lies close enough to be the source of these toads). However, when these toads were observed, it was reportedly two to three years since the last

inundation of the playa, and a decade since the last inundation prior to that (Turner and others 1997). The Sonoran green toad, Great Plains narrow-mouthed toad, and burrowing tree frog occur in the Vekol Valley, located just east of the BMGR, and may occur in open water habitats on the BMGR (Barry 2002d).

Both permanent and ephemeral tinajas may support a variety of temperate and tropical aquatic invertebrates (Larsen and Olson 1997). Some of the invertebrates are habitat generalists, though others are unique to tinajas and/or to a particular tinaja (Larsen and Olson 1997, Kingsley 1998). The importance of these habitats to invertebrates is not well understood; however, it is possible that there are invertebrates endemic to desert tinajas on the BMGR. Some scientists believe that non-native flora and fauna are absent or rare in tinajas (Hall and others 2001), but there are no data to support this hypothesis nor are there data comparing native and non-native species composition in natural tinajas and developed waters.

Additional information about the management of wildlife waters is provided in Section 4.6.3.

4.6.1.3 Vertebrate Fauna Inventory

The fauna of the BMGR is very diverse and also includes protected species, such as the Sonoran pronghorn, which are discussed in Section 4.7. Lists of the mammal, reptile/amphibian, and bird species known or expected to occur on the BMGR, including the Cabeza Prieta NWR are provided in Appendix D, Tables D-2, D-3, and D-4. No similar list has been compiled for invertebrate species, but such a list would likely exceed 2,000 species (U.S. Air Force 1986).

The list of vertebrate species is arranged by Order, Family, Subfamily, and Species in accordance with the general format and nomenclature used by the sources cited (U.S. Air Force 1986; Jones and others 1986; American Ornithologists' Union 1983; Deamaree and others 1972, Monson and Phillips 1981; Rosenberg and others 1991; and Stebbins 1985).

For each individual species, an indication is provided as to the relative abundance of the species on the BMGR. For birds, the seasonal distribution on the BMGR is listed. For all vertebrates, the habitat type or types in which the species most commonly occurs is provided. Species abundance is, at least for some species, closely linked with the amount of rainfall the BMGR receives in any given year. Some species, particularly rodents, are far more abundant during comparatively wet years over dry years. Amphibians may only be common or abundant above ground during a very brief season and in a very limited locality. Because the Cabeza Prieta NWR was included within the BMGR land withdrawal prior to the passage of the MLWA of 1999, the list remains inclusive of species that occur within the refuge.

4.6.1.4 Large Mammals

Desert Mule Deer

Desert mule deer occupy mountains, hills, and desert washes, and are reliant on perennial water. Based on the AGFD Mule Deer Distribution Map (AGFD 2002b), most of the BMGR is considered marginal habitat for mule deer (particularly west of State Route 85), although they are more common than white-tailed deer. Mule deer are the most numerous and widely distributed of the big game on the range. In southwestern Arizona, desert mule deer are not migratory and have reported home range areas of 121 square kilometers for females (Rautenstrauch and Krausman 1989). During dry periods, mule deer are especially dependent on the availability of perennial water sources, and the presence of man-made water tanks is an important welfare factor (Hoffmeister 1986). Desert mule deer adapt to hot and dry periods by modifying their activity. They have been reported to decrease their daytime activity and increase their nighttime activity to avoid hot daytime temperatures (Hays and Krausman 1993). The BLM has identified mule deer habitat on the BMGR as being east of the Mohawk Mountains (U.S. DOI, BLM 1990b). However, mule deer probably extend farther west as indicated by observations of mule deer sign (Fisher 1993) and sightings made during Sonoran pronghorn census flights in 1992 and 1994 (Gilbert 1994). Mule deer recently have been documented on the western edge of the Cabeza Prieta NWR (Spiller 1994).

White-tailed Deer

In Arizona, white-tailed deer occur throughout central and southern Arizona, but not in the southwestern portion of the state. White-tailed deer are typically found at higher elevations than mule deer. Breeding occurs between mid-December and March, with the peak in January. Most fawns are born in July and August in Upland Habitats, coincident with the new plant growth following the summer rains (AGFD 2002b). White-tailed deer are found on the far eastern edge of the BMGR (U.S. DOI, BLM 1990b) and are known from the Sauceda, Sand Tank, Growler, and Ajo mountains (Hoffmeister 1986).

Desert Bighorn Sheep

Desert bighorn sheep occupy essentially all upland habitats within the BMGR (U.S. DOI, BLM 1990b). They prefer the steep and rough terrain of the higher elevations; however, they will move down onto the bajadas when forage is available, sometimes crossing valleys between mountain ranges. On rare occasions bighorn sheep utilize lowland habitats, especially when moving from one mountain range to another. When crossing, they tend to take the shortest routes possible across level terrain (Simmons 1980). Bighorn require steep terrain for escape from predators and for lambing areas. Bighorn forage on forbs, grasses, and shrubs, which are also

preferred by burros (U.S. DOI, BLM 1990b). In southern Arizona, lambing can occur in any month; however, it tends to peak during January, February, and March. The peak reproduction (rut for rams, estrus for ewes) is during July, August, and September (Russo 1956). During rut, bighorn rams are noted for their spectacular head-on clashes. Group size and composition is variable and dependent on season. On the Cabeza Prieta NWR, group size has been reported to range from one to 15 individuals with a mean group size of three. Except during the reproductive period, groups tend to be segregated into those of adult rams and mixed groups of ewes, lambs, and juveniles (Simmons 1969). The mountain lion is the major predator of the sheep. Shrub density and height may be an important aspect of bighorn habitat. Lower shrub densities and heights provide less cover for lions and may allow sheep to more easily detect and escape predators.

Historically, sheep populations are depleted over much of the area due to poaching, mining, disease, competition with livestock, and other human activities such as recreational use in important habitat, road traffic, and fence construction. Furthermore, highways and railroads have disrupted traditional movement routes, isolating areas of habitat. Although desert bighorns occupy only a small portion of their original distribution, Arizona's desert bighorn sheep population has increased 25 percent in one decade from an estimate of 4,500 in 1988 to around 6,000 in 1998. This increase is largely attributed to the coordinated modern management of providing and maintaining water sources, translocating new herds, developing partnerships with private groups, and collaborating among agencies to consider bighorn sheep needs during habitat management planning processes (Lee 1998). See Section 4.6.1.10 for a discussion of the desert bighorn sheep as a species conservation element.

Javelina

The range of the collared peccary (also known as javelina) encompasses much of southern Arizona, a small portion of extreme southern New Mexico, southern Texas, and south as far as northern Argentina in South America (Hoffmeister 1986; Nowak and Paradiso 1983). In Arizona, they occur in the southeastern and central portion of the state with isolated populations in the west (Hoffmeister 1986). Statewide, the most important and productive biotic community for collared peccary is the Arizona Upland Subdivision of the Sonoran Desert. In Arizona, javelina can give birth to young in every month of the year, although young are mostly born between June and August, with July being the peak month. Javelina eat roots, tubers, seeds, mesquite beans, green vegetation, cactus fruits, agaves, and prickly pear cactus pads. When the opportunity presents itself, they will also eat dead birds or rodents (Phillips and Comus 2000). Peccaries typically form stable herds of variable sizes. Predators of peccaries include coyotes, bobcats, and mountain lion (Hoffmeister 1986). Javelina are scattered in small herds primarily east of State Route 85 where succulent vegetation such as buckhorn cholla, prickly pear, and agave are more prevalent and are commonly observed in the Sauceda and Sand Tank mountains. Several javelina have been sighted in the vicinity of the Tinajas Altas Mountains by Border

Patrol and AGFD personnel (Gilbert 1994). Like mule deer, javelina prefer washes and bajadas. Within their range, javelina distribution is limited by available water.

Carnivores

Carnivores present on the BMGR include mountain lion, kit fox, gray fox, coyote, bobcat, raccoon, coati, ringtail, badger, and skunk. Mountain lions are seldom seen but occur throughout the BMGR range. Although it is possible to find mountain lions anywhere on the range, their population density is very low. These large predators must cover extensive areas to maintain their existence. Previous studies have shown that lions have ranges of 25 square miles or more. They are most common in rugged, heavily vegetated areas, but can be found in any habitat that supports good prey populations (Phillips and Comus 2000). On the BMGR, they are found primarily in rugged terrain on the eastern BMGR (U.S. Air Force 1986). It is suspected that some mountain lions on the BMGR, particularly within BMGR-West, may be a subspecies referred to as the Yuma puma. Although anatomical corroboration for the subspecies status is still being assembled, it has been listed as a Wildlife of Special Concern in Arizona by the AGFD (AGFD 1996 in preparation) and is thus further addressed in Section 4.7.

The bobcat is both more common and widely distributed in the Sonoran Desert than the mountain lion. It hunts smaller prey, but can and does take prey as large as Sonoran pronghorn on occasion. Bobcats occupy the same habitats as mountain lions, but can more easily adapt to marginal habitats. The bobcat's home range is only a few square miles. If prey is scarce, bobcats may wander extensively (Phillips and Comus 2000, Morgart 2002c).

Coyotes are extremely adaptable, wide ranging, and may be encountered in almost any habitat, but are generally less common in rocky uplands. Gray foxes occur along major washes and in rocky uplands where they prey on a variety of small mammals, birds, and reptiles. Kit foxes inhabit the open, sparsely vegetated valley bottoms where they dig dens in deeper, friable soils and prey on kangaroo rats, pocket mice and other rodents, and rabbits.

Hoffmeister (1986) lists a single record for ringtail from the BMGR in the Tinajas Altas Mountains near the Mexican border; however, ringtails have also been reported at Baker Peaks and at water sources in the Gila and Tinajas Altas mountains (U.S. Air Force 1999). This species' primary distribution in Arizona is in the southeastern and central parts of the state.

At lower elevations, badgers are found most commonly on alluvial fans and flats adjacent to mountain ranges (Hoffmeister 1986). Badgers are present on the range where they prey primarily on burrowing species of rodents (U.S. Marine Corps 1997).

4.6.1.5 Small Mammals

Small mammals on the range include jackrabbits, cottontails, and many species of bats and rodents. Bat species observed on the BMGR include California leaf-nosed bat, cave myotis, western pipistrelle, California myotis, pallid bat, lesser long-nosed bat, and big brown bat (Dames & Moore 1996 and 1997b). The greater western mastiff bat may also be present with limited occurrence on the range (Barry 1997). Other small mammals found on the range include heteromyid (pocket mice and kangaroo rats) rodents, ground squirrels, wood rats, and grasshopper mice.

4.6.1.6 Birds

As listed in Appendix D, Tables D-4 and D-5, more than 200 bird species may occupy the BMGR and Cabeza Prieta NWR. The validated bird species listed in Table D-4 are most likely breeding and migratory birds that may occur at the BMGR and Cabeza Prieta NWR as validated by the cited sources. The species listed in Table D-5 are those species that may hypothetically occur in the area based on the cited sources. Relative abundance is noted in terms of seasonal distribution (i.e., permanent resident, summer resident, winter resident, transient, irregular or erratic, casual, accidental, and status uncertain) and breeding status (i.e., breeding is known to occur or breeding suspected, but no recorded observations).

Throughout the BMGR, desert riparian areas support the largest populations of breeding birds and they are also important habitat for migratory birds. Avifauna of the BMGR is at its highest species diversity in vegetation of the Arizona Upland Subdivision. The structural diversity and density of vegetation provides habitats for a large number of bird species. Saguaros provide nesting substrate for cavity nesting birds, including American kestrel, elf owl, Gila woodpecker and gilded flicker. Harris' hawks may also nest in saguaros and hunt where perch sites are available. Other birds associated with Arizona Upland vegetation include cactus wren, curve-billed thrasher, verdin, Gambel's quail, white-winged dove, mourning dove, and greater roadrunner. Loggerhead shrikes have been observed in upland areas as well as on broad alluvial valley bottoms dominated by creosotebush (Dames & Moore 1996).

Creosotebush communities (Lower Colorado River Valley Subdivision) provide suitable habitat to limited numbers of bird species (Turner and Brown 1982). LeConte's thrashers, black-throated sparrows, and lesser nighthawks breed in creosotebush associations. Several species of migratory, wintering birds (including larks, buntings and sage sparrows) are associated with creosotebush vegetation.

Initial neotropical migratory bird surveys on the BMGR performed from 1994 through 1996 on three transects with ten count stations on each transect found that 71 percent of 110 species of birds recorded were breeding or passage neotropical migrants (University of Arizona 1997).

These surveys are continuing on a biannual basis (see Section 4.6.3 for more information on ongoing survey activities)

4.6.1.7 Reptiles and Amphibians

The herpetofauna of the BMGR, including the Cabeza Prieta NWR, include those listed in Appendix D, Table D-3. Among the amphibians, the Sonoran Desert toad may occur throughout the BMGR. The remaining amphibians are not active except during periods of warm weather rainfall and are most likely to be above ground in response to summer and early autumn rains. Couch's spade-foot, Great Plains, and red-spotted toads are known to occur in various places on the BMGR, especially in the vicinity of natural or manmade water catchments and flooded mine tunnels.

The herpetofauna of the BMGR, including the Cabeza Prieta NWR, consists of desert tortoise (Sonoran population), lizards (including Gila monster), and snakes (Appendix D, Table D-3). This assemblage of species is characteristic of Sonoran Desert habitats. Many have their population centers in the arid Southwest (e.g., Sonoran population of the desert tortoise, Gila monster, desert iguana, chuckwalla, long-tailed brush lizard, spotted leaf-nosed snake, banded sand snake, and sidewinder) while others are more widespread (common collared lizard, western whiptail, coachwhip, gopher snake, and night snake). Six species of rattlesnakes (western diamondback, Mohave, speckled, black-tailed, tiger, sidewinder) have been confirmed to occur on the range (Barry unpubl. data). In addition, Cowle's fringe-toed lizard occurs on the Mohawk Sand Dunes and other sandy areas throughout the BMGR (Turner and others 1997).

4.6.1.8 Exotic, Invasive, or Noxious Species

<u>Africanized Honey Bee</u>

The Africanized honey bee, *Apis mellifera scutellata*, has become naturalized in the BMGR region and is particularly abundant around water sources. In June 2000, honey bees were collected from 54 water developments located north of the BMGR on Yuma Proving Ground, Kofa NWR, and adjacent BLM lands. The majority of those collected, 87 percent, were Africanized as determined through mitochondrial DNA analysis (Rosenstock and Rabe 2002). Honey bee populations became established in the Southwest in the distant past, perhaps as feral descendants of bees introduced by the Spanish in the 16th century. It has been speculated that the establishment of this insect may have important consequences for native insects and flowering plants because native bees are responsible for an estimated 70 percent of flowering plant pollination (Buchmann and Nabhan 1997). The effects of honey bee introduction have never been well established. In the early 1990s, a previously foreign parasitic mite became established in Arizona with devastating effects on wild and domestic honey bees. Most feral honey bee

colonies were destroyed by this parasite. A new race of honey bee, the Africanized bee (also called African or killer bee) is highly resistant to this parasite, and invaded the southwestern United States in the mid-1990s. This bee can be dangerous to people and animals because it is very aggressive and defensive, and will mob and sting any intruder.

Non-native Birds and Insects

Several non-native bird species (rock dove, European starling, and house sparrow) have become established in the general area. Their populations are limited primarily to human settlements, although individuals may occasionally wander onto the BMGR. Of these, the European starling is of particular concern because this species was reportedly sighted in seven different 2001 Arizona Breeding Bird Atlas survey blocks on the BMGR. Their range may expand into the desert, as they accompany the spread of agricultural activities and urban expansion. The lush saguaro-rich areas in the eastern BMGR (Sand Tank Mountains) are vulnerable to starling invasion as suburban areas associated with the Phoenix metropolitan area expand towards the BMGR (Hall and others 2001). Furthermore, there is evidence that this species may compete with other species that nest in saguaro cavities, particularly the Gila woodpecker. Likewise, non-native insects (other than the Africanized honey bee) may also reside on the BMGR, but none have been identified as an issue for resource management.

Feral Burros

A small transient population of feral burros is known to occur on the BMGR east of State Route 85. Little information is available at this time on this population, but at one point in the 1980s the population was estimated at 50 to 150 animals. These burros were thought to move seasonally between the BMGR in winter and the Tohono O'odham Reservation in summer; however, recent information indicates that they are permanent residents in the eastern part of East TAC.

Burros were domesticated more than 6,000 years ago (Nowak 1991) and were brought to the southwestern United States by the Spanish in the sixteenth century. Burros are abundant in many places in Arizona, especially in many of the desert ranges along and near the Lower Colorado River (Hoffmeister 1986). For populations studied near the Colorado River, group composition was variable and averaged 4.7 individuals and their mean annual home range was 19.2 square kilometers (Seegmiller and Ohmart 1981). Burros feed on nearly all available desert vegetation. The destruction of native food and pollution of water holes by burros have caused problems for other native wildlife, especially the bighorn sheep (Hoffmeister 1986).

Trespass Cattle

Periodically, cattle trespass onto the BMGR from adjacent lands where livestock grazing occurs. Problem areas currently identified include portions of BMGR—East (including Ajo Air Force Station, north boundary near Gila Bend AFAF where the range is adjacent to Sonoran Desert NM, and the East TAC-Tohono O'odham Nation boundary), where there are unfenced boundaries or fences in disrepair adjacent to areas of open grazing for livestock.

4.6.1.9 Wildlife Movement Corridors and Barriers

Large mammals, such as mule deer, white-tailed deer, bighorn sheep, Sonoran pronghorn, javelina, mountain lion, and burros may move from one place to another on the BMGR (including the Cabeza Prieta NWR) generally following seasonal patterns in search of food or water and/or in response to changing environmental factors. Natural barriers to wildlife include abrupt escarpments and mountain ridges that prevent or discourage their occupancy as habitats (Lee and others 1998). Highways, fences, railroads, and irrigation canals along the BMGR perimeter are partial or complete barriers to movement of these species. Major highways in the vicinity include Interstate 8, State Route 85, and Mexico Highways 2 and 8. The effect of highways as barriers to Sonoran pronghorn movement may be attributed to the right-of-way fence, substantial increase in traffic volume, and probably the increase in average speed over the last 30 years (USFWS 1998a). Surrounding land use may have reduced wildlife access to historic water sources adjacent to the range. For example, Interstate 8 north of the range and Highway 2 south of the range restrict access to water in the Gila and Sonoyta rivers, respectively.

Fences are located along the BMGR perimeter, such as along the State Route 85 corridor, and within other operational areas of the BMGR, primarily for security and safety purposes. Railroads in the vicinity include the currently inactive Tucson, Cornelia, and Gila Bend railroad and the two Union Pacific Railroad lines located north of the BMGR. Major canals in the vicinity of BMGR include the Gila Bend, Wellton, and Mohawk canals. More information regarding these transportation corridors can be found in Section 4.10.

Mountain passes, including the Mohawk Pass and Cipriano Pass, provide important corridors for movement of some wildlife between major BMGR valleys. Migratory bird corridors in the Sonoran Desert are often influenced by the availability of open water. Desert riparian areas are also used as corridors for wildlife movement as they provide more cover and forage than adjacent habitats and have terrain that supports the movement for many species.

4.6.1.10 Species Conservation Elements

By facilitating input from a panel of experts, TNC identified 11 individual wildlife species or guilds of species, 13 natural community elements, and one plant species conservation element as appropriate foci for biodiversity management planning purposes in the EIS analysis for the BMGR INRMP (Hall and others 2001). Some of these species conservation elements are protected by federal and state authority. These protected species are identified herein, but not discussed fully as they are addressed in detail in the section that follows (Section 4.7, Protected Species). The 11 wildlife species conservation elements include one guild of amphibians, three individual species and one guild of reptiles, one individual species and one guild of birds, and three individual species and one guild of mammals. This discussion in this section is based on the work of TNC in *Conservation Elements and a Biodiversity Management Framework for the Barry M. Goldwater Range, Arizona* (Hall and others 2001). This document should be consulted as reference material for more details and specific sources of information.

Amphibians

Ephemeral Water-Breeding Amphibian Guild. – Three amphibian species, the Sonoran Desert toad (*Bufo alvarius*), red-spotted toad (*B. punctatus*), and Couch's spadefoot (*Scaphiopus couchii*) together comprise the ephemeral water-breeding amphibian guild. These species were grouped together because of the potential shift in competitive advantage between them for a particular type of water resource for breeding and larval development.

The Sonoran Desert toad is found in a wide variety of habitats from mesquite-creosotebush lowlands to bajadas, oak-sycamore-walnut association in mountain canyons, and tropical deciduous thornscrub in Mexico. Its range extends from the Lower Colorado and Gila rivers of Arizona and extreme southwestern New Mexico south to northwestern Sinaloa and extreme southeastern California. It occurs from sea level to above 4,000 feet MSL. It is typically found at ephemeral, intermittent, or semi-permanent waters, but can also be found at permanent water sources. It can venture several miles from water and breeds in most any water source. For successful reproduction, however, this species requires water sources that persist for longer durations than some other desert anurans.

The principal food source of the Sonoran Desert toad is beetles. Sonoran Desert toads spend the winter underground in kangaroo rat burrows and are active mostly during the summer rainy season, from May to September. Adult Sonoran Desert toads travel between water sources at night using creosotebush areas. Individuals can live between 10 to 20 years and development from the larval stage to the adult takes six to 10 weeks.

Red-spotted toads are generally associated with rocky slopes and arroyos in desertscrub, thornscrub, and lower montane woodlands. This species breeds in springs and temporary pools

of seasonal streams and seeks shelter in rocky areas alongside these water sources. On the BMGR, it is associated with temporary pools and natural tinajas in bedrock bajadas and mountains and would be unlikely to breed in modified water sources found away from canyons and rock slopes. The principal food source of the red-spotted toad is insects. This species is nocturnal in the summer, but it may be active during the day in cooler weather. It breeds mainly after summer rains and its larvae metamorphose in six to eight weeks.

Couch's spadefoot is seasonally found in arid conditions in areas of sandy soils, creosotebush, mesquite, desert grasslands, and prairies. Although this species benefits from human-made/altered water sources in the desert, it is a particularly important component of the fauna associated with natural, seasonal water sources on the BMGR, particularly playas. The species breeding behavior is more closely tied to major rainfall events and ephemeral water sources than the Sonoran Desert toad.

These toads have extremely rapid metamorphosis, with eggs hatching within a day and larvae maturing into terrestrial juveniles in less than two weeks on average. Juveniles and adults bury themselves using their "spade foot" into sandy soil to avoid heat and desiccation, and they spend the dry season underground in deep burrows made by gophers, kangaroo rats, or themselves. They are mostly active at night during summer rains in the Sonoran Desert. If insufficient rain occurs, adults apparently can remain underground for more than a year. The main food sources of Couch's spadefoot are insects, including beetles, grasshoppers, katydids, ants, spiders, and termites.

Threats to these species are not well known. These three anuran species may compete for the available natural and human-developed water sources on the BMGR and the competitive advantage between the species for a particular type of water resource for breeding and larval development may shift depending on the type of water resource considered (playa versus tinaja, modified versus natural tinaja, ephemeral versus permanent water, etc.). At least within valley habitats in the Organ Pipe Cactus NM, much of the known or suspected primary frog and toad breeding sites are at waters of human origin or modification (Rosen and Lowe 1996). In one study, permanent-pool breeders (frog species in the Ranidae Family) were more successful than typical ephemeral-pool breeders (including spade foot toad species) when they were both found in permanent waters (Woodward 1982).

Reptiles

Desert Tortoise (Sonoran population). – While the Sonoran population of the desert tortoise (*Gopherus agassizii*) was identified as a species conservation element, it is also listed as a Wildlife of Special Concern in Arizona (AGFD 1996 in preparation). Thus, it is discussed in detail in Section 4.7.1. This species was selected as a conservation element because of its

sensitivity to the effects of climate change and potential impacts from military and recreation activity.

Flat-tailed Horned Lizard. – The flat-tailed horned lizard (*Phrynosoma mcallii*) species conservation element is listed as a Wildlife of Special Concern in Arizona (AGFD 1996 in preparation). Thus, it is discussed in detail in Section 4.7.1. This species was selected as a conservation element because the BMGR is the most protected portion of its range, making it extremely important to the long-term persistence of this species.

Cowles Fringe-toed Lizard. – The Cowles fringe-toed lizard (*Uma notata rufopunctata*) conservation element is also listed as a Wildlife of Special Concern in Arizona (AGFD 1996 in preparation). Thus, it is discussed in detail in Section 4.7.1.

Valley Bottom Reptile Guild. – This guild is comprised of the western spotted leaf-nosed snake (*Phyllorhynchus decurtatus perkinsi*), Colorado Desert shovel-nosed snake (*Chionactis occipitalis annulata*), sidewinder (*Crotalus cerastes*), desert iguana (*Dipsosaurus dorsalis*), southern desert horned lizard (*Phrynosoma platyrhinos calidiarum*), and long-tailed brush lizard (*Urosaurus graciosus*). As a group, these species are found in the lowest, driest, and most sparsely vegetated areas of the Sonoran Desert. They are not limited, however, to a single natural community type within the Lower Colorado River subdivision. The BMGR may function as an important center of each species' distribution in which the populations are more abundant and viable than at other locations.

The selection of this guild and its members is based, in part, on the species rich assemblages of the reptile and lizard communities. The BMGR represents a large, relatively undisturbed expanse of low desert communities in the most arid portion of the Sonoran Desert in the United States and is likely an extremely important area for the conservation of this guild.

The range of the western spotted leaf-nosed snake extends from the Mojave and Sonoran deserts in California and southern Nevada to western Arizona and into northeastern Baja California and northwestern Sonora. It occurs in areas up to 3,000 feet MSL and, in the United States, generally corresponds with the distribution of creosotebush. As a soft-soil, excavating specialist, the western spotted leaf-nosed snake is found on open desert plains in sandy or gravelly soils. Its localized distribution may prove to be as centered on the valley floors, especially within the Valley Bottom Floodplain Complex Natural Community, as any other member of the herpetofauna. This species eats small lizards and their eggs.

The sidewinder is distributed throughout the Mojave and western Sonoran Deserts from southeast California to southern Nevada, southwestern Utah, southeastern Baja, southwestern Arizona, and northwestern Sonora. It is usually found in open valleys with sand, loam, and silt soils, especially in creosotebush flats, dunes, and creosotebush-bursage habitats. The sidewinder eats small mammals and lizards.

The Colorado Desert shovel-nosed snake has a more restricted range than the sidewinder in the Mojave and Sonoran deserts. One of four recognized subspecies of the western shovel-nosed snake, the Colorado Desert subspecies, is found in southwestern Arizona and southeastern California to the most northern reaches of Baja California and Sonora arching around the Gulf of California. It is found in the driest parts of the desert, where vegetation is sparse and may include creosotebush, some grasses, and mesquites. This species frequents dunes, washes, sandy flats, and occasionally rocky hillsides with sandy areas between the rocks. It is known to eat invertebrates.

The range of the desert iguana extends from the Mojave Desert in east-central California and southern Nevada to the Sonoran Desert in western Arizona. It further extends through the desert regions of Baja California, Sonora, and Sinaloa. In these areas, the desert iguana is usually found in sandy creosotebush flats and hummocks. It is also found along xeroriparian areas, silty floodplains, and clay soils. Creosotebush apparently is important to this species. It provides a food source—fresh leaves, buds, and flowers—and a favorable habitat for burrowing around its roots, which provides protection from heat extremes and predation. Primarily herbivorous, it also eats insects, carrion, and its own fecal pellets.

The southern desert horned lizard is a widespread and abundant lizard of the desert. The species is a background matcher that likely has genetic differentiation across its distribution on the BMGR. The BMGR is important in protecting the genetic diversity of the species and constitutes a major part of the heart of this species' distribution and abundance. The southern desert horned lizard is probably represented better on the BMGR than anywhere else in Arizona. It is most commonly found around dunes, along washes, and on sandy soils, and is generally associated with creosotebush, saltbush, and mixed cacti. The lizard eats ants, other insects, spiders, and some plant materials, such as berries.

The long-tailed brush lizard is commonly found on the BMGR. Like the southern desert horned lizard, it is probably represented better on the BMGR than anywhere else in Arizona. The BMGR is also the place where the distributions of the two subspecies overlap/come together and is therefore important in protecting some of the genetic diversity found in this species.

Invasive species are potential threats to this guild because (1) they alter vegetation resulting in a decrease in the food base and productivity of the habitat for insectivorous species, and (2) dense growth patterns of some invasives can impede the locomotion of open-ground running lizards and their ability to escape predators, especially raptors and diurnal snakes. Among the members of the guild, the desert iguana is particularly affected by invasive species. The ability of invasive plants to carry fire also can cause habitat disturbance and negatively affect guild members. Long-tailed brush lizard populations are especially affected by fires because of the reduction in vegetation structure of desert perennials.

Large roads and vehicle traffic are known to cause the death of individuals that move across or stop to bask on roads. However, most BMGR roads are narrow and used on a fairly infrequent basis. Frequent and/or intense ground-disturbing military activity within creosotebush flats and valley bottoms is a source of habitat disturbance for this guild.

Birds

Le Conte's Thrasher. – The distribution of Le Conte's thrasher is limited mostly to low desert areas in the Sonoran and Mojave deserts in western, southcentral, and southwestern Arizona, southern Nevada, southeastern California, extreme southwestern Utah, northwestern Sonora and northeastern Baja California in Mexico, and disjunct populations in the San Joaquin Valley, California and central and coastal Baja California. The extent of its known distribution has not changed appreciably since the 1890s other than a contraction of its range because of habitat loss. The BMGR represents an important center of Le Conte's thrasher distribution in the United States. The Cabeza Prieta NWR and BMGR combined contain the largest population of this species across its entire range.

Le Conte's thrasher is one of the few birds that is associated with the low, arid desert valley bottoms. The species seems to be persisting where its habitat is intact, but it is intolerant of habitat disturbance associated with human activity. Availability of suitable habitat seems to be the major factor limiting population density and distribution. Le Conte's thrasher is designated a Species of Special Concern by the California Department of Fish and Game, but does not currently have similar designated state status in Arizona. The Arizona Working Group of Partners in Flight recognize Le Conte's thrasher in the Arizona Partners in Flight Bird Conservation Plan as one of five bird species that serve as indicators of Sonoran desertscrub habitat health (Latta and others 1999).

Typical habitat throughout the range of the species consists of sparsely vegetated desert flats, sand dunes (vegetated margins), alluvial fans, or gently rolling hills containing one or more species of relatively tall saltbush and/or cylindrical cholla cactus. Saltbush-dominated areas are particularly favored by Le Conte's thrashers.

Le Conte's thrashers are an uncommon resident of the desert Southwest. They have a spotty distribution within creosotebush-dominated habitats. It is mostly insectivorous, feeding on soil larvae, but it may also eat spiders, centipedes, small lizards, berries, and seeds. Feeding usually takes place in the early morning and at dusk, when insects are most active. Almost all food is found under the litter of desert vegetation or on the substrate; as a result, the species requires accumulated leaf litter under most plants within its territory to provide diurnal cover for its arthropod prey. Le Conte's thrashers are not dependent on free-standing water, as they derive their water from their food.

Le Conte's thrashers are non-migratory birds. In Arizona, the species most frequently nests in shrubby trees and shrubs. Individual territories are about five to six acres in size and are likely centered about the nest site.

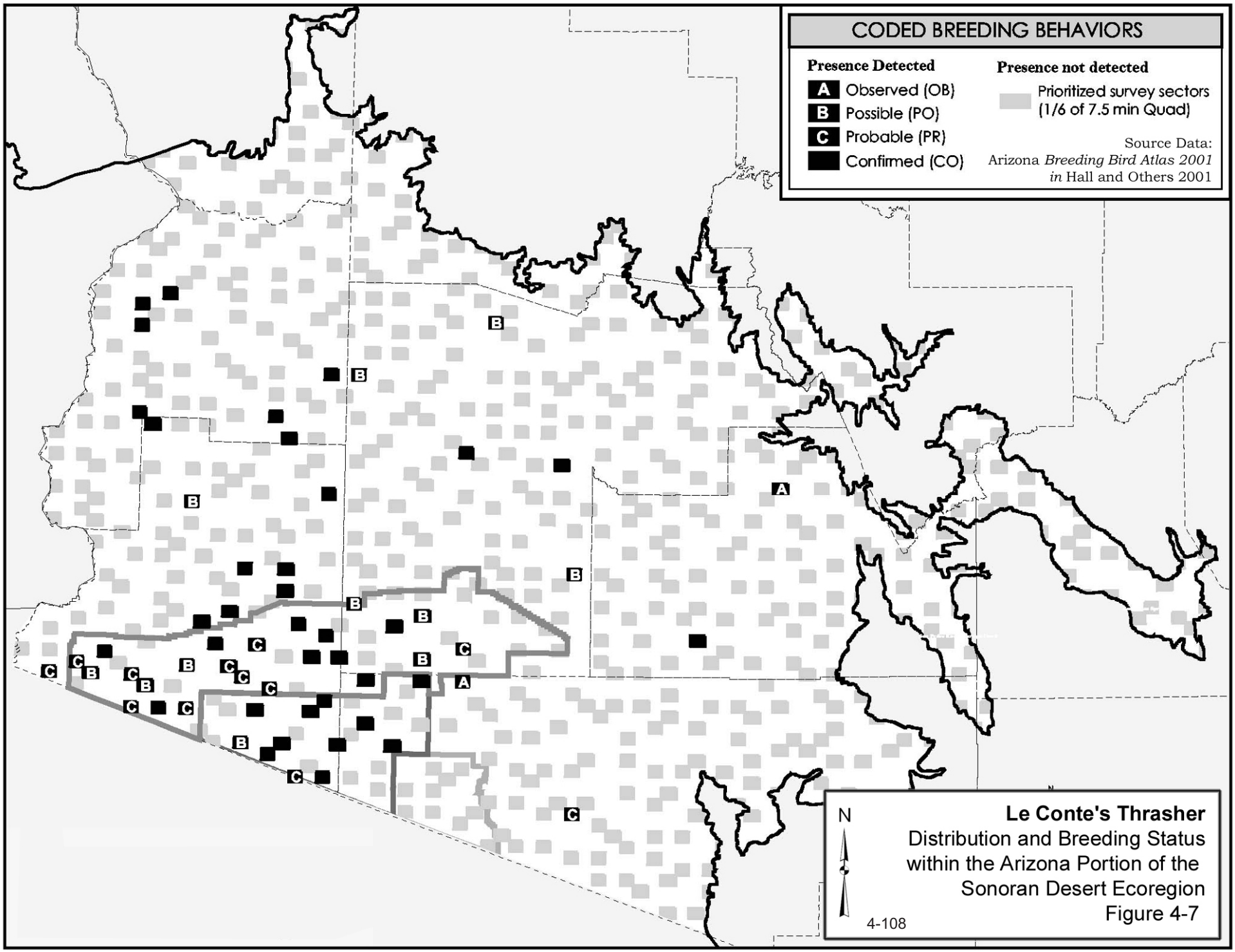
Figure 4-7 shows the distribution and breeding status within the Arizona portion of the Sonoran Desert ecoregion and breeding pair abundance on the BMGR and Cabeza Prieta NWR of Le Conte's thrasher as identified by the Arizona Breeding Bird Atlas data (AGFD 2001c). The abundance of the breeding birds is representative of that found elsewhere. Four sectors on the BMGR and six on Cabeza Prieta NWR contained 11 to 100 breeding pairs. The BMGR contains 38 percent of the survey sectors within the ecoregion within which Le Conte's thrasher was at least detected, and 25 percent of the survey sectors in which breeding was confirmed. Breeding status was at least possible on all BMGR survey sectors (see Figure 4-8 and interpretation of breeding codes in Appendix E. The survey sectors in which species presence was detected align with the natural community conservation elements and Le Conte's thrasher seems to associate with those natural communities that are characteristic of the Lower Colorado River Valley subdivision.

High impact, widespread use of valley bottoms by the military is a threat, particularly in the western portion of the BMGR, although currently the military does not have a large impact on Le Conte's thrasher habitat.

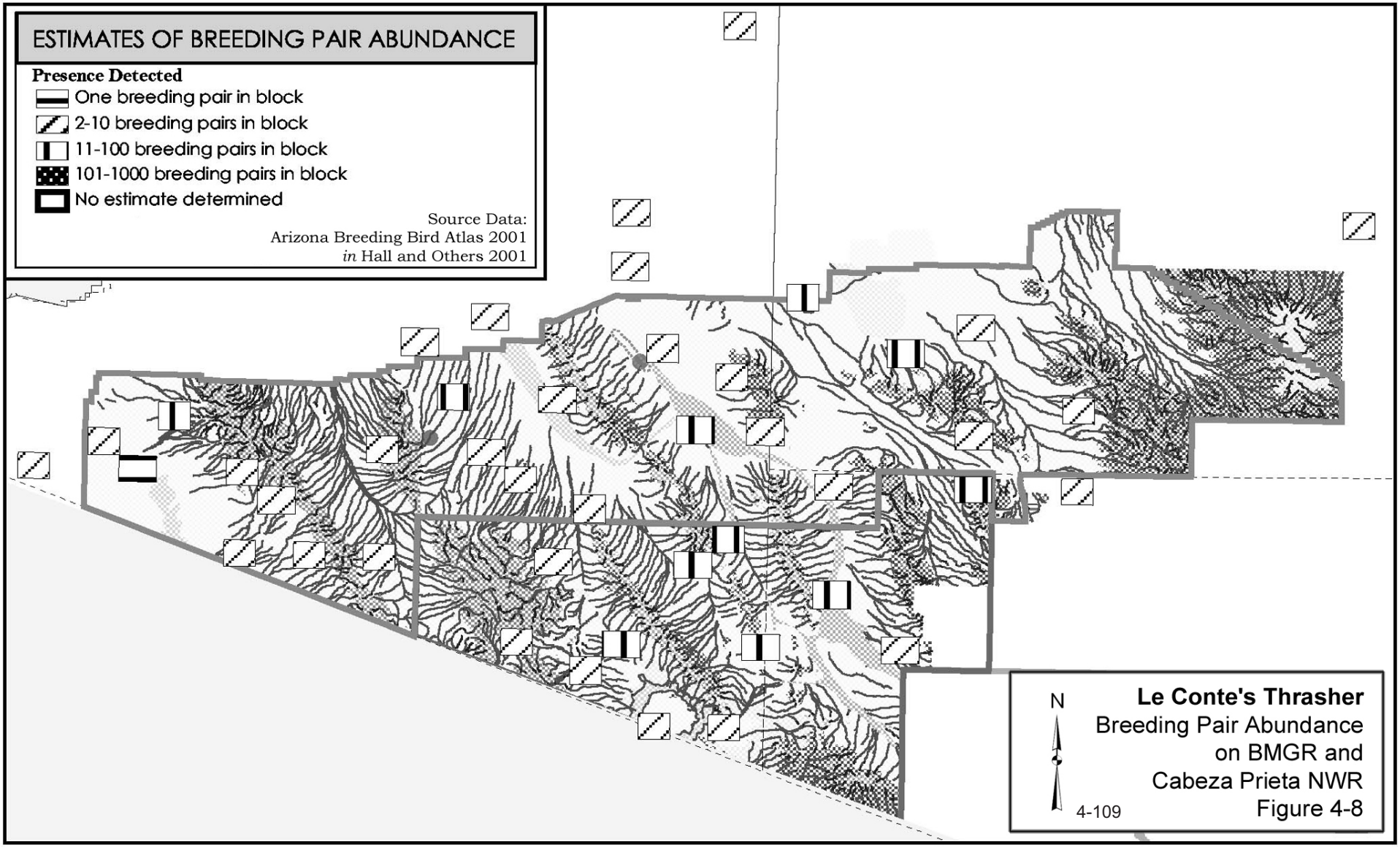
Primary Excavator (Cavity) Guild. – This guild is composed of the gilded flicker (*Colaptes chrysoides*), Gila woodpecker (*Melanerpes uropygialis*), and ladder-backed woodpecker (*Picoides scalaris*). As a group, these woodpeckers create nest sites that are secondarily used by many other cavity-nesting birds, bats, and invertebrates. On the BMGR, gilded flickers and Gila woodpeckers predominantly use saguaros for nest sites. The characteristics of the cavity, which may be related to the excavation techniques of each species, may affect which secondary cavity nesters use the nest site once the woodpecker vacates the cavity. Ladder-backed woodpeckers do not typically excavate their nest cavities within saguaro; instead, they use mesquite, paloverde, ironwood trees, and agave stalks.

The abundance of Gila woodpeckers and gilded flickers closely correlates with the abundance of saguaros although there is a variation in abundance of each related to other biotic and abiotic factors. Ladder-backed woodpeckers potentially can occur wherever large mesquite, paloverde, or ironwood trees are present.

Neither Gila woodpeckers nor gilded flickers require standing water. They get their water from food, especially cactus fruits and nectar. Gila woodpeckers are omnivorous. They capture insects by probing within or gleaning from the bark of trees and cacti; they also will go to the ground to



Le Conte's Thrasher
Distribution and Breeding Status within the Arizona Portion of the Sonoran Desert Ecoregion
Figure 4-7


ESTIMATES OF BREEDING PAIR ABUNDANCE
Presence Detected
One breeding pair in block
2-10 breeding pairs in block
11-100 breeding pairs in block
101-1000 breeding pairs in block
No estimate determined
Source Data:
Arizona Breeding Bird Atlas 2001
in Hall and Others 2001
N
Le Conte's Thrasher
Breeding Pair Abundance
on BMGR and
Cabeza Prieta NWR
Figure 4-8

capture visible food items. They also eat cactus fruit, mistletoe berries, and bird eggs. Ladder-backed woodpeckers are primarily insectivorous bark probers and gleaners. They also will eat cactus fruit.

Gilded flickers are residents in southeastern California, northeastern Baja California, and central Arizona south to southern Baja California and through Sonora, Mexico to northern Sinaloa. Gila woodpeckers are mostly permanent residents in southeastern California, extreme southern Nevada, extreme southwestern New Mexico, the southern half of Arizona, most of Baja California except for the northwest corner, and south into central Mexico in a band along the eastern shore of the Gulf of California. Ladder-backed woodpeckers are residents from the southwestern United States to northeastern Nicaragua.

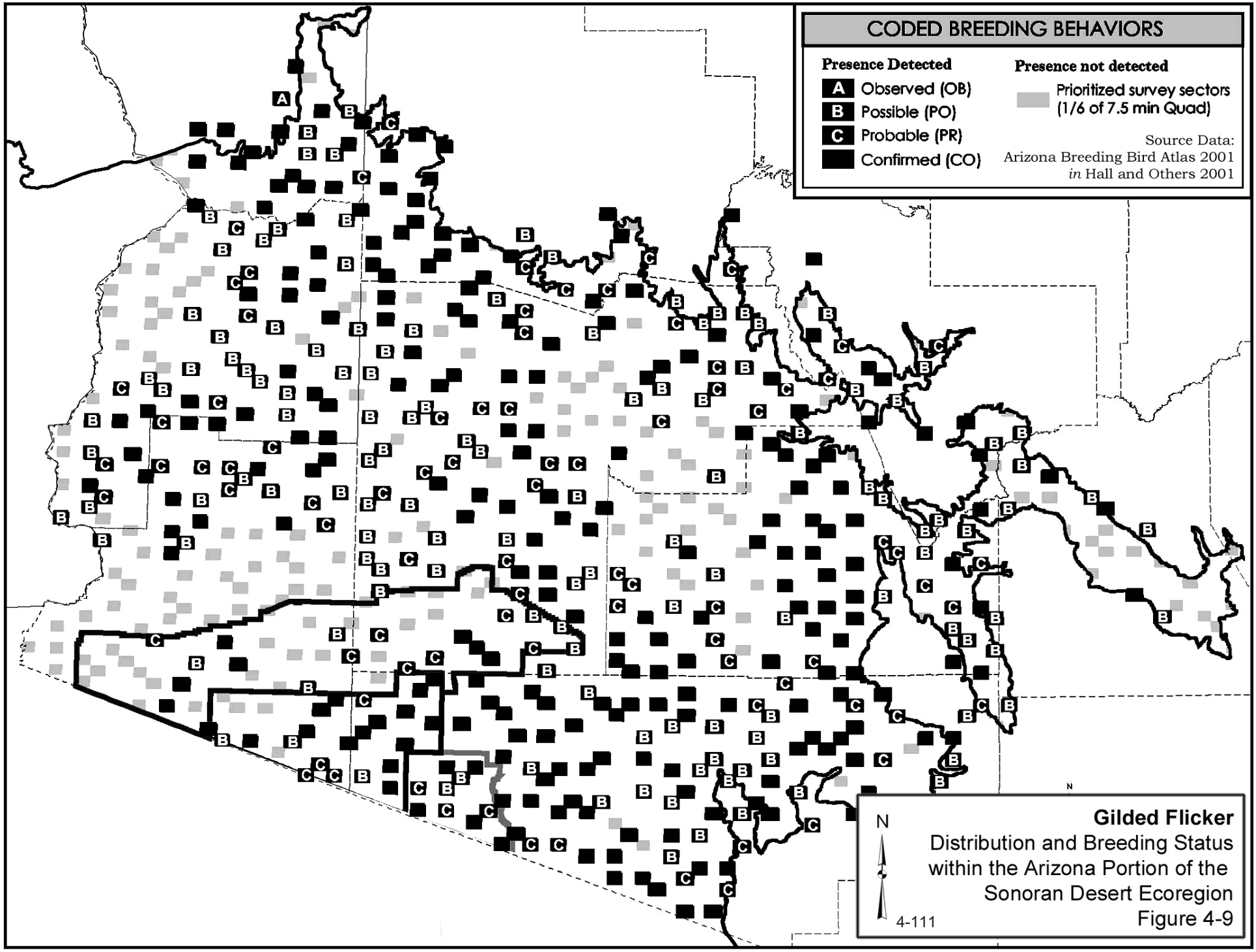
Figures 4-9 through 4-14 show the distribution and breeding status within the Arizona portion of the Sonoran Desert ecoregion and breeding pair abundance on the BMGR and Cabeza Prieta NWR of the members of this guild. As illustrated in these figures, the main distribution and highest breeding pair densities of the guild on the BMGR are east of State Route 85 in the Sand Tank and Sauceda mountains. Distribution within BMGR—West tends to be along washes that can support saguaros and/or leguminous trees. Both the gilded flicker and Gila woodpecker decrease in abundance from east to west, and the Gila woodpecker seems to be less abundant than the gilded flicker in the western portion of the BMGR (Figures 4-12 and 4-13). Ladder-backed woodpeckers do not necessarily show a decline in breeding pair abundance from east to west across the BMGR (Figure 4-14). Cabeza Prieta NWR seems to have relatively high breeding pair abundances for all three members of the guild (Figures 4-12 through 4-14). When these data are compared with natural community conservation elements, each species corresponds with xeroriparian scrub habitat, especially west of State Route 85.

The non-native European starling can out compete other saguaro cavity nesters. They compete with Gila woodpeckers, but not with gilded flickers. The European starling is already found in some areas of the BMGR and the eastern areas of the BMGR in the Sand Tank Mountains are vulnerable to further invasion.

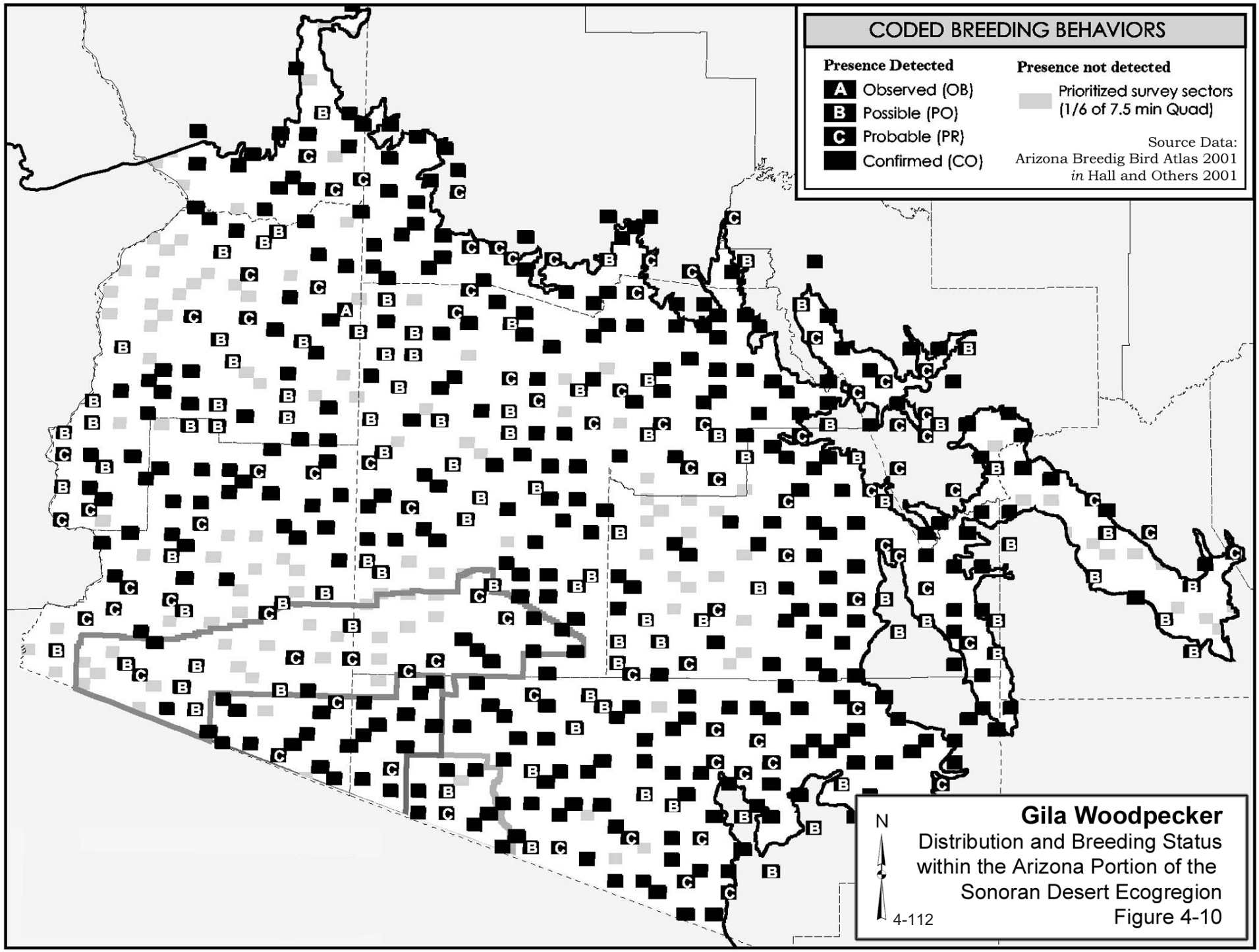
Mammals

Sonoran Pronghorn. – This species conservation element is also a protected species. Thus, it is discussed in detail in Section 4.7.1. This species was identified as a conservation element to allow for completeness and because the Sonoran pronghorn's presence plays a role in determining appropriate recommendations for designating special management areas and/or developing managements standards for a particular area of the BMGR that is within its range.

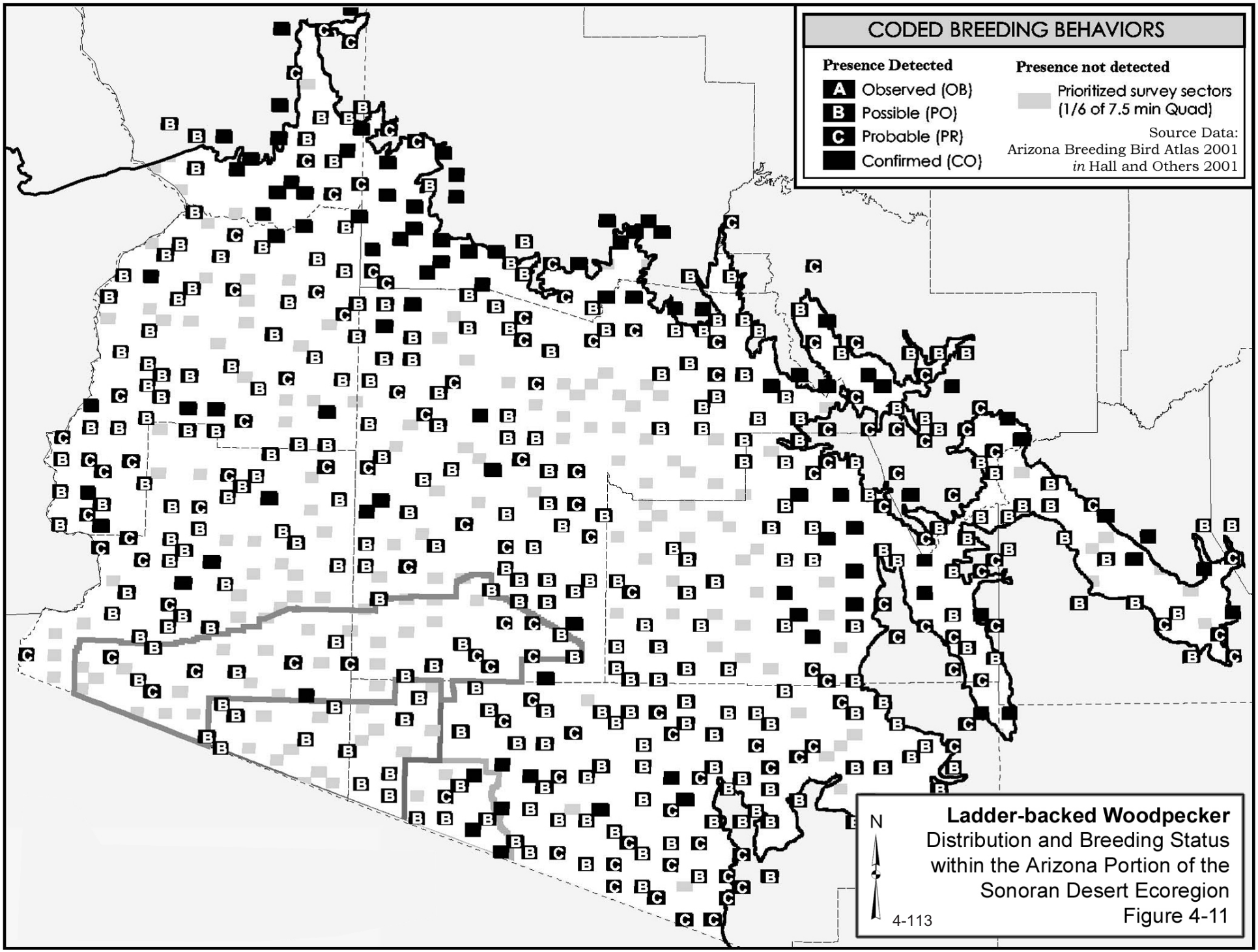
Desert Bighorn Sheep. – The general characteristics of desert bighorn sheep biology are discussed in Section 4.6.1.4; thus this discussion focuses on this species as a conservation



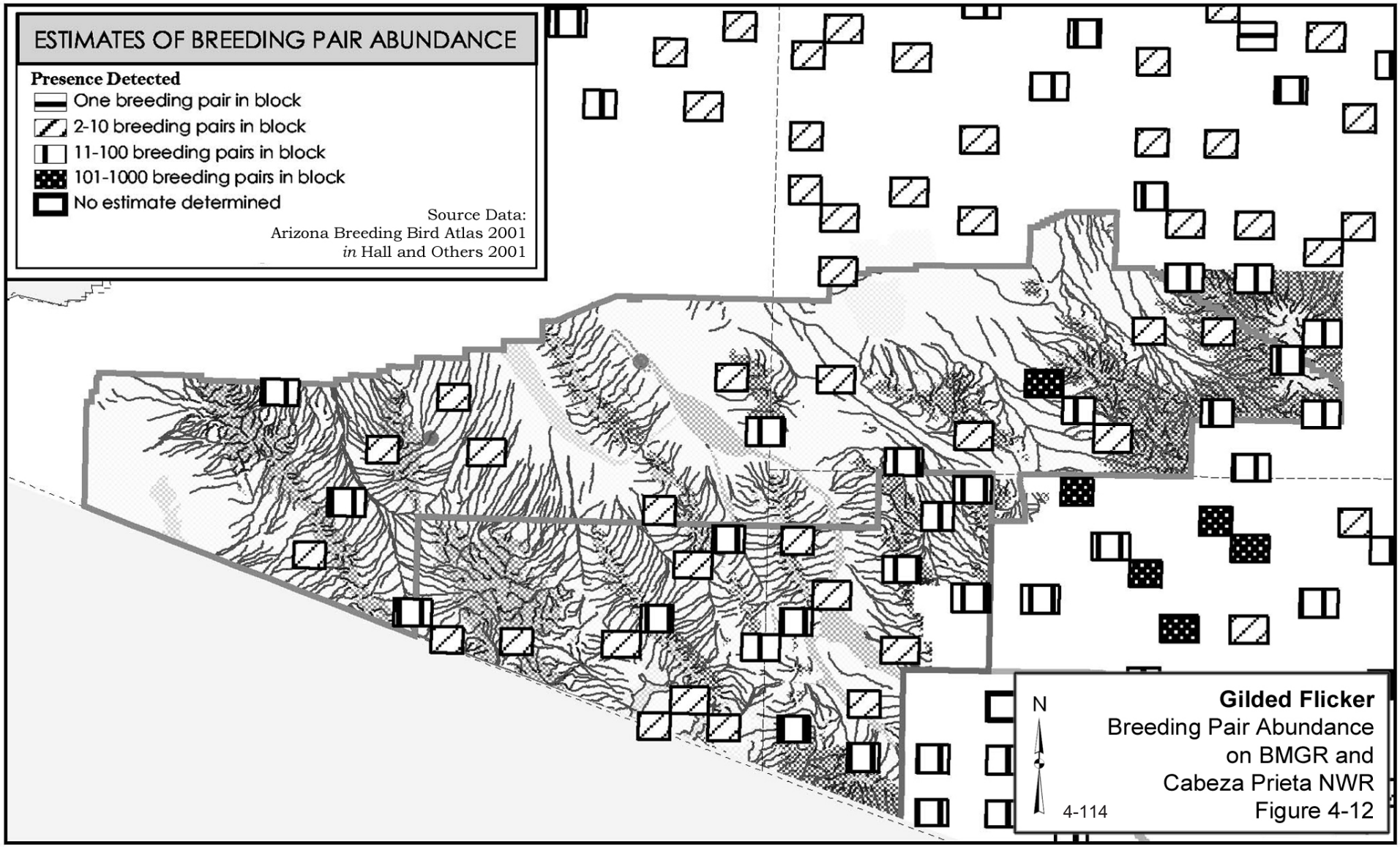
Gilded Flicker
Distribution and Breeding Status within the Arizona Portion of the Sonoran Desert Ecoregion
Figure 4-9



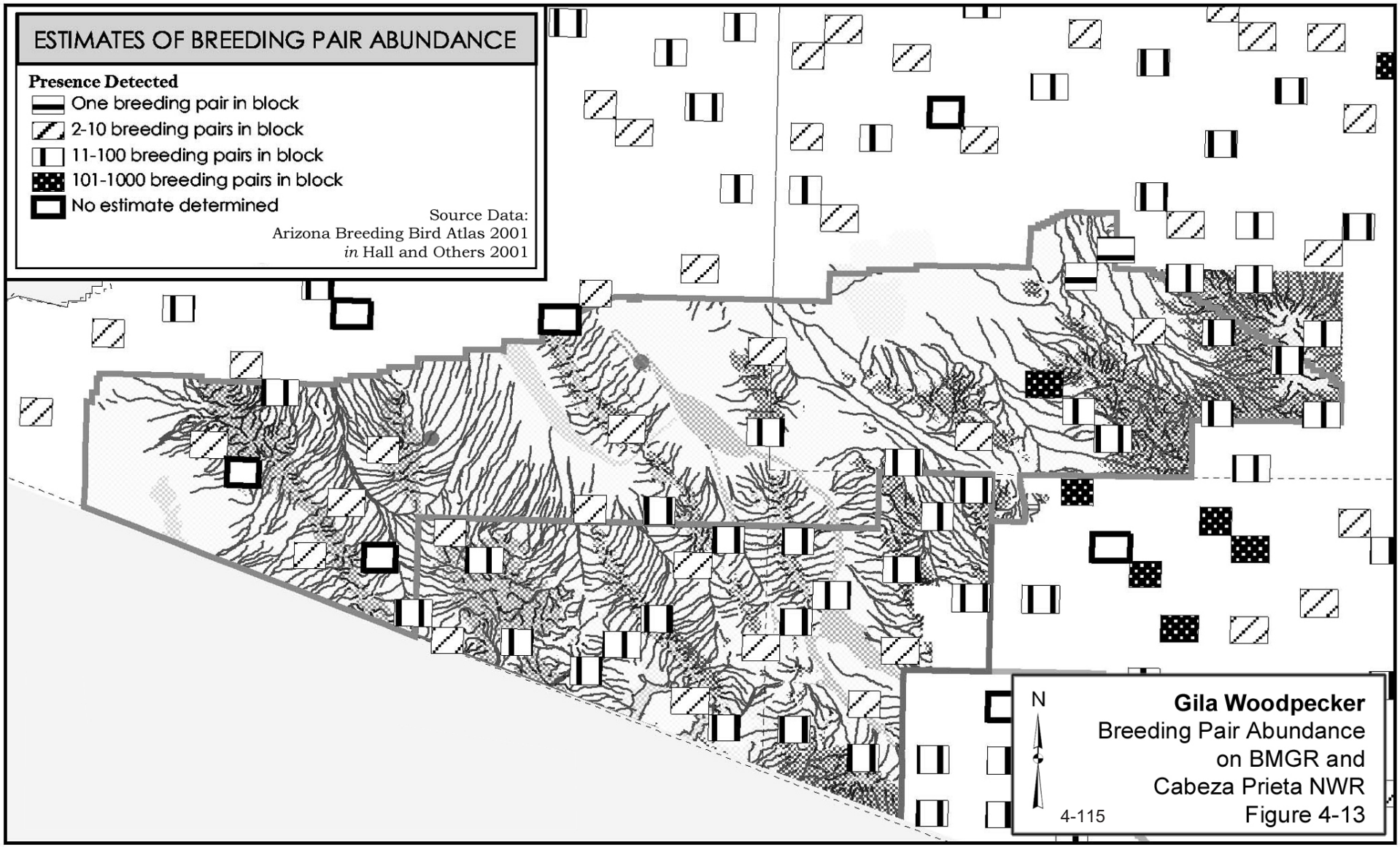
Gila Woodpecker
Distribution and Breeding Status within the Arizona Portion of the Sonoran Desert Ecogregion
Figure 4-10



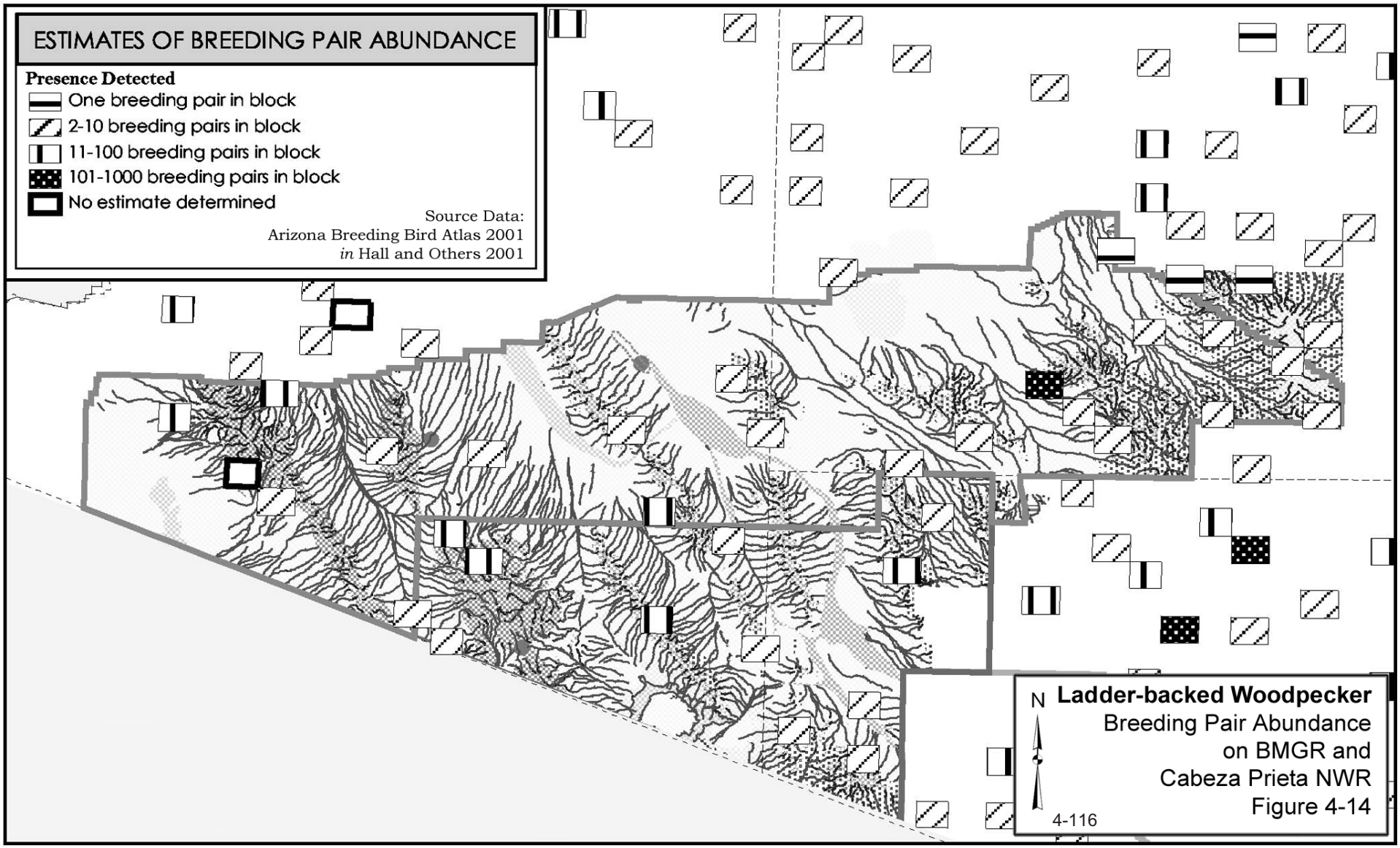
Ladder-backed Woodpecker
Distribution and Breeding Status within the Arizona Portion of the Sonoran Desert Ecoregion
Figure 4-11



Gilded Flicker
Breeding Pair Abundance
on BMGR and
Cabeza Prieta NWR
Figure 4-12



Gila Woodpecker
Breeding Pair Abundance
on BMGR and
Cabeza Prieta NWR
Figure 4-13


ESTIMATES OF BREEDING PAIR ABUNDANCE
Presence Detected
One breeding pair in block
2-10 breeding pairs in block
11-100 breeding pairs in block
101-1000 breeding pairs in block
No estimate determined
Source Data:
Arizona Breeding Bird Atlas 2001
in Hall and Others 2001
N
Ladder-backed Woodpecker
Breeding Pair Abundance
on BMGR and
Cabeza Prieta NWR
Figure 4-14

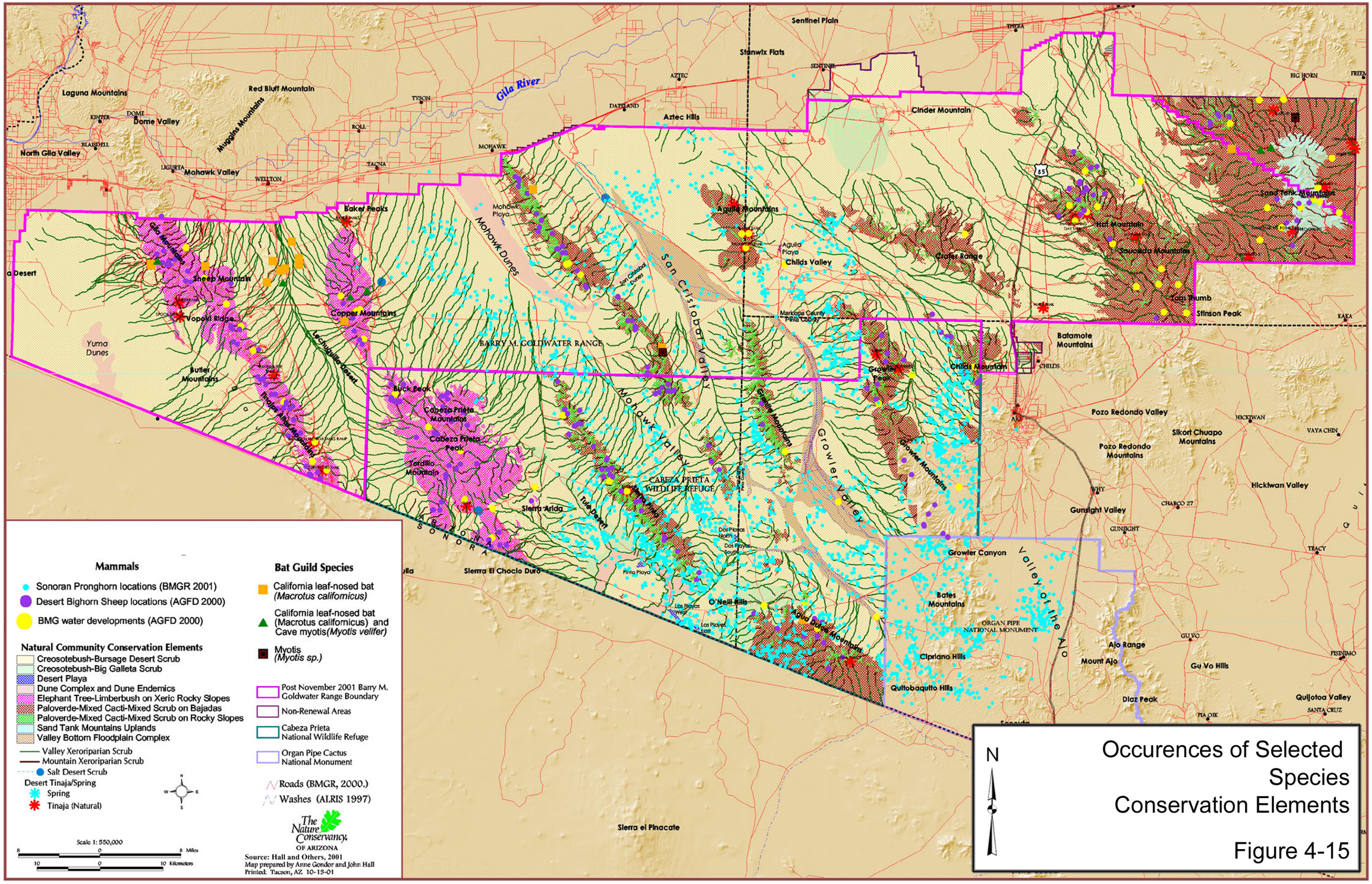
element. The desert bighorn sheep was selected as a conservation element because the BMGR and the adjoining lands in Cabeza Prieta NWR, Sonoran Desert NM, and Organ Pipe Cactus NM are important for the long-term persistence of desert bighorn sheep. The BMGR-Cabeza Prieta NWR-Organ Pipe Cactus NM area contains one interbreeding population of desert bighorn. At least the Sand Tank Mountains portion of the Sonoran Desert NM also is part of this interbreeding population. This area provides desert bighorn with a large landscape that is free of most of the critical threats that this species encounters in many other parts of its desert range. The area is free of many large roads that cause genetic isolation—a common threat in small-patch populations found elsewhere throughout the desert bighorn's range. While recreation use has affected some bighorn sheep populations in other regions, the recreation use on the BMGR is not known to affect the health of resident bighorn sheep populations. The BMGR also is favorable because it lacks large populations of wild burros that compete for forage and water (Hall and others 2001).

Table 4-16 lists recent population estimates provided by the AGFD for desert bighorn sheep on the BMGR and Cabeza Prieta NWR. These estimates were derived from aerial surveys conducted by the AGFD. Surveys followed a set protocol and population estimates were calculated using an estimator that relies on frequencies of observed group sizes. All mountain ranges are not surveyed each year, so the listed population estimates are based on the most recent data available for each range. Desert bighorn sheep are known to occur in all mountains of the BMGR; however, the AGFD has not conducted recent surveys and cannot provide population estimates for the Crater Mountains, Aguila Mountains, and the part of the Granite Mountains that is outside of the Cabeza Prieta NWR. Figure 4-15 depicts geospatial data on bighorn sheep survey locations throughout the BMGR and Cabeza Prieta NWR.

TABLE 4-16
POPULATION ESTIMATES OF DESERT BIGHORN SHEEP ON THE BMGR AND CABEZA PRIETA NWR

Cabeza Prieta NWR[1]		BMGR: West of State Route 85		BMGR: East of State Route 85	
Mountain Range	Population Estimate	Mountain Range	Population Estimate	Mountain Range	Population Estimate
Growler	55	Gila[2]	69	Sauceda[3]	35
Agua Dulce	31	Tinajas Altas[2]	91	Sand Tank[3]	37
Granite	8	Mohawk/Copper[3]	88		
Childs	18	Crater	—		
Cabeza Prieta	97	Aguila	—		
Tule	27				
Sierra Arida	7				
Sierra Pinta	102				
Bryan/Mohawk	43				

Source: AGFD, Engel 2002a
[1] 1999 estimate
[2] 2000 estimate
[3] 2001 estimate


Occurences of Selected Species Conservation Elements
Figure 4-15
N
Mammals
Sonoran Pronghorn locations (BMGR 2001)
Desert Bighorn Sheep locations (AGFD 2000)
BMG water developments (AGFD 2000)
Natural Community Conservation Elements
Creosotebush-Bursage Desert Scrub
Creosotebush-Big Galleta Scrub
Desert Playa
Dune Complex and Dune Endemics
Elephant Tree-Limberbush on Xeric Rocky Slopes
Paloverde-Mixed Cacti-Mixed Scrub on Bajadas
Paloverde-Mixed Cacti-Mixed Scrub on Rocky Slopes
Sand Tank Mountains Uplands
Valley Bottom Floodplain Complex
Valley Xeroriparian Scrub
Mountain Xeroriparian Scrub
Salt Desert Scrub
Desert Tinaja/Spring
Spring
Tinaja (Natural)
Bat Guild Species
California leaf-nosed bat (Macrotus californicus)
California leaf-nosed bat (Macrotus californicus) and Cave myotis(Myotis velifer)
Myotis (Myotis sp.)
Post November 2001 Barry M. Goldwater Range Boundary
Non-Renewal Areas
Cabeza Prieta National Wildlife Refuge
Organ Pipe Cactus National Monument
Roads (BMGR, 2000.)
Washes (ALRIS 1997)
The Nature Conservancy OF ARIZONA
Source: Hall and Others, 2001
Map prepared by Anne Gondor and John Hall
Printed: Tucson, AZ 10-15-01
Scale 1: 550,000
8 0 8 Miles
10 0 10 Kilometers
Gila River
Laguna Mountains
Red Bluff Mountain
Muggins Mountains
Dome Valley
North Gila Valley
Mohawk Valley
Sentinel Plain
Stanwix Flats
Aztec Hills
Cinder Mountain
Baker Peaks
Mohawk Dunes
Mohawk Playa
Aguila Mountains
Aguila Playa
Childs Valley
Crater Range
Sand Tank Mountains
Hat Mountain
Saucedo Mountains
Tom Thumb
Stinson Peak
Batamote Mountains
Childs Mountain
Growler Peak
Growler Mountains
San Cristobal Valley
Mohawk Valley
Growler Valley
Glip Mountains
Sheep Mountain
Vopoki Ridge
Copper Mountains
Yuma Dunes
Butler Mountains
Tinajas Altas Mountains
Lechuguilla Desert
BARRY M. GOLDWATER RANGE
Buck Peak
Cabeza Prieta Mountains
Cabeza Prieta Peak
Tordillo Mountain
CABEZA PRIETA WILDLIFE REFUGE
Sierra Arida
Tule Desert
Sierra El Chocio Duro
Pinta Playa
O'Neill Hills
Agua Dulce Mountains
Growler Canyon
Bates Mountains
ORGAN PIPE NATIONAL MONUMENT
Cipriano Hills
Quitobaquito Hills
Valley of the Ajo
Pozo Redondo Valley
Pozo Redondo Mountains
Sikort Chuapo Mountains
Hickiwan Valley
Gunsight Valley
Ajo Range
Mount Ajo
Gu Vo Hills
Diaz Peak
Quitotoa Valley
Sierra el Pinacate
SONORA
ARIZONA

Some movement of sheep likely occurs between all of the mountain ranges on the BMGR and Cabeza Prieta NWR. The AGFD has never identified specific movement corridors in the area, but they can be assumed to exist between any adjoining ranges. Typically, bighorn sheep traverse valleys quickly during mild weather and by the shortest routes possible across flat terrain.

Hunting does not seem to pose a threat, nor do current military activities on the BMGR, including overflights.

Kit Fox. – Kit foxes are associated with open and level ground in low desertscrub and semi-desert grassland habitats that are characterized by sandy soils (soft alluvial soils and sand dunes) that provide for easy digging. They are found in the low, arid, sandy regions of the Mojave, Chihuahuan, and Sonoran deserts and the southern portions of the Great Basin Desert. Within the Sonoran Desert they are found in creosotebush-bursage and saltbush related community types.

Kit foxes occur throughout the BMGR in the low desert. Many kit fox dens have been observed in East TAC between the Sauceda and Sand Tank mountains, and foxes are often observed along the road coming into the Sauceda Mountains from the west. It is possible that they may decrease in abundance in the western portion of the BMGR; however, little is known about their populations. The preferred source of food for the kit fox is kangaroo rats, although they also feed on a variety of other rodents, as well as insects, lizards, and birds. Kit foxes get their water from their food. They feed opportunistically, changing prey base with seasonal abundance and with prey population fluctuations. Although kit foxes avoid heavily vegetated riparian zones, open stock pond areas were found to be important resource-rich patches where individuals feed on many rodents and lagomorphs other than kangaroo rats.

Kit foxes are nocturnal and carnivorous. They dig multiple den holes, which they use year-round for raising young and to escape daytime heat. They are solitary but form pairs in the early spring during the breeding season. Young are born in February or March. Based on the number of dens and apparent population density, kit foxes seem to have relatively small home ranges of between 10 and 100 acres.

Current military operations do not seem to have a noteworthy effect on kit foxes. No apparent effects of noise are indicated from military overflights of kit fox populations, and prey populations were not significantly different on and off military target areas (Hall and others 2001).

Bat Guild. – This guild is composed of the California leaf-nosed bat (*Macrotus californicus*), cave myotis (*Myotis velifer*), and lesser long-nosed bat (*Leptonycteris curasoae yerbabuenae*). Because the lesser long-nosed bat is a federally endangered species and the California leaf-nosed bat is listed in Wildlife of Special Concern in Arizona (AGFD 1996 in preparation), detailed information about these species appears in Section 4.7.1.3. This species guild was selected as a conservation element because each species relies on the availability of caves and/or mines for

roosting, and roosting colonies of bats are vulnerable to disturbance. Recreation (e.g., exploring mines) and management (e.g., mine closure or reclamation) activities are potential threats. Additionally, each species relies on xeroriparian areas, high-density saguaro stands, and open water sources to meet their food and water requirements.

Cave myotis are distributed throughout the Sonoran Desert. This bat seems to be uncommon on the BMGR although the Sand Tank Mountains are probably an important area for this species. The northern and eastern boundary areas of the BMGR are the most important areas for cave myotis. The bat probably decreases in abundance heading west on the BMGR. Only one roosting site has been found, near Sand Tank Well, at an elevation of 2,360 feet MSL. Additionally, cave myotis were captured near managed wildlife waters at three sites located in the Sand Tank Mountains, one in the Saucedas, and one site east of Javelina Mountain.

This bat uses mine shafts, tunnels, caves, and the underside of bridges as roost sites within the desertscrub habitats of the Sonoran Desert. The species usually roosts near the entrances of mine shafts or tunnels and, as a result, can use tunnels as short as 100 feet. Of the nine species of *Myotis* that occur in Arizona, the cave myotis shows the greatest correspondence with Sonoran Desert habitats. Xeroriparian corridors and large open water sources are important foraging areas. Areas with saguaros are important because they attract many insects. Roosts are situated within several miles from water sources.

Some cave myotis in southern Arizona migrate in the winter to locations above 6,000 feet MSL in the southernmost part of the state to hibernate; however, most individuals probably migrate outside of Arizona to the south. Nursery colonies may support from 50 to 15,000 female bats. Females move north during early April and arrive at the nursery colony already pregnant. Young are born in mid-June. Females leave the nursery colonies in August and join the males. Individuals seem to show fidelity to roost locations. Home range estimates for a population (individuals occupying one or several mine tunnels in close proximity) range from 360 to 625 square miles.

Cave myotis are insectivorous and catch prey in flight using echolocation. This species drinks from free water at tanks, tinajas, and guzzlers.

4.6.2 Interrelationship Between the Military Mission and General Wildlife Resources

While ground disturbance, noise, and ordnance delivery may adversely affect some wildlife and wildlife habitat on specific locations of the range, prohibitions on mining, geothermal development, livestock grazing, agriculture, and other uses that disrupt habitat have helped to preserve these resources in general. While this protective character was initially unplanned, the legacy is expected to continue because, in addition to meeting the national defense mission, the DoD has stewardship responsibilities for proper management of the natural and cultural

resources present on the BMGR. Although, by statute, the military mission takes precedence, requirements for protection, preservation, and conservation are also clear. Management for no net loss to mission capabilities, however, is often fully compatible with management of wildlife and wildlife habitats. NEPA compliance requires that potential adverse impacts to wildlife and wildlife habitats be taken into consideration in the planning stages for major undertakings. In some cases, the military is required to modify their mission-related activities on the BMGR in order to minimize or eliminate potential impacts. The DoD has an interest in taking proactive measures to protect general wildlife and wildlife habitat so that the military mission is not further constrained by the listing of additional species and the sometimes competing requirements to protect them. Authorized non-military activities occurring on the BMGR that are compatible with the military mission but may impact wildlife or wildlife habitat include wildlife management activities, hunting, recreation, and Border Patrol activities.

Existing military ground impacting activities on wildlife habitat has been minimal and is widely dispersed, with about 2.3 percent of the range having had a high to complete level of ground disturbance. The majority of military activities that have surface impacts take place in lowland habitats, so wildlife species that typically occupy creosotebush desertscrub and desert riparian habitats have the greatest potential for direct interaction with military activities. Species that frequent creosotebush desertscrub habitat include Sonoran pronghorn, coyotes, kit fox, badgers, kangaroo rats, pocket mice, LeConte's thrasher, loggerhead shrikes, black-throated sparrows, lesser nighthawks, and various reptile species. These species may also be found in valley xeroriparian areas, as may mule deer, gray foxes, bobcats, and Harris' hawks. Fencing, installed for public safety and military security purposes, can change wildlife movements or deny wildlife access to certain areas.

Military features within target areas and at developed facilities sometimes provide artificial wildlife habitat. For instance, elevated military structures are sometimes used as perch sites for raptors and other bird species. Small mammals burrow in target areas where soil has been loosened by target construction and maintenance and/or munitions impacts. Surface disturbing activities that alter natural runoff patterns, such as collection of rainwater in disturbed soils (e.g., bomb craters, along roadsides) and application of water for dust suppression, can also create more mesic microhabitats in localized areas that support more lush vegetation that attracts foraging wildlife. Reptiles, small mammals, and invertebrates may use targets (car bodies, simulated tanks, etc.) and/or munitions debris (expended munitions casings, parachutes, etc.) for cover.

Awareness training for military personnel that train on the BMGR focuses on wildlife sensitivity and wildlife hazards. Ground personnel are made aware of venomous wildlife hazards present on the BMGR. Air operators must consider the potential for bird/aircraft collision, referred to as the bird aircraft strike hazard (BASH). Bird strikes are most likely to occur during low-level flights, where the concentration of birds is the highest.

Both Luke AFB and MCAS Yuma have trained biologists on staff and various programs and surveys for which additional biologists or wildlife scientists may be hired.

4.6.3 Existing Regulatory and Statutory Requirements and Management Plans and Actions

4.6.3.1 Regulatory and Statutory Requirements

As outlined in Section 1.2 and Table 1-1, four agencies have primary responsibility for natural resources, and thus management of wildlife and wildlife habitats, on the BMGR—the Air Force, Navy/Marine Corps, AGFD, and USFWS. The BLM's part is also notable in that this agency was assigned responsibility for management prior to the passage of the MLWA of 1999.

Many of the management responsibilities and regulatory requirements that relate to general wildlife and wildlife habitats pertain primarily to protected species and are thus discussed in Section 4.7.3. Those that are more applicable to general wildlife and wildlife management are as follows:

- **Executive Order 13112, *Invasive Species.*** Requires federal agencies to identify actions that may affect invasive species, use relevant programs to prevent introduction of invasive species; detect, respond, and control such species; monitor invasive species populations; provide for restoration of native species; conduct research on invasive species; and promote public education.

- **Sikes Act (16 U.S.C. 670a et seq.)**. Provides for cooperation by the Departments of the Interior and Defense with State agencies in planning, development, and maintenance of fish and wildlife resources on military reservations throughout the United States. A cooperative plan is to be developed to provide for fish and wildlife habitat improvements or modifications; range rehabilitation where necessary for support of wildlife; control of off-road vehicle traffic; and specific habitat improvement projects and related activities, including adequate protection for species of fish, wildlife, and plants considered threatened or endangered.

- **DoD Instruction 4715.3, *Environmental Conservation Program.*** Outlines DoD policy for the management of natural resources and the preparation of INRMPs. The most applicable provisions with regard to general wildlife and wildlife habitat are those requirements to manage natural resources to support and be consistent with the military mission, while protecting and enhancing those resources for multiple use, sustainable yield, and biological integrity; to base land use practices and decisions on scientifically sound conservation procedures and techniques, and use scientific methods and an ecosystem approach; to incorporate the principles of ecosystem management in

INRMPs; to inventory, manage, and protect biologically or geographically significant or sensitive natural resources or species; and to promote biodiversity.

- **Fish and Wildlife Conservation Act of 1980.** Promotes state programs to conserve, restore, and benefit non-game fish and wildlife and their habitat.

- **Title 17 of the Arizona Revised Statutes, Game and Fish.** Directs the responsibility for maintenance and management of the State's wildlife resources to the Commission and AGFD. ARS 17-102 establishes that most wildlife in Arizona is the property of the State. ARS 17-231 establishes that through the Commission, the AGFD may establish policies and programs for the management, preservation, and harvest of wildlife; establish hunting, trapping, and fishing rules and prescribe the manner and methods which may be used in taking wildlife; enforce laws for the protection of wildlife; and develop and distribute information about wildlife and activities of the AGFD.

- **Arizona Administrative Code Rules, Title 12, Natural Resources, Chapter 4, Game and Fish Commission.** Under the authority of ARS 17-201 et. seq., establishes detailed rules for licenses and permits, taking and handling of wildlife, live wildlife, heritage grants, and wildlife areas among others.

4.6.3.2 Management Plans and Actions

Goldwater Amendment

As stated in Section 2.1, the existing range-wide resource management plan for the BMGR, the Goldwater Amendment, established overall natural and cultural resource management direction for the range and prescribed that a series of component subplans be prepared to determine guidance for specific management issues and locations. Included among the subplan requirements are specifications for HMPs and a transportation plan.

The designation of special/natural interest areas under the Goldwater Amendment provided some degree of protection to some wildlife and wildlife habitat (see Section 4.11 for more details regarding these special management areas). Many of the wildlife-related management objectives outlined in the Goldwater Amendment were focused on special status species. Many others set forth what should be addressed in the HMPs for the enhancement or maintenance of wildlife and wildlife habitat, including evaluating the development and improvement of water sources for species dependent on open water, evaluating the cumulative impacts of land disturbance on wildlife habitat in order to establish criteria for protection of important habitat when making land use decisions, and establishing wildlife inventories and monitoring for game and non-game species to provide information for guiding land use decisions. Other general wildlife management objectives include compliance with NEPA and ESA regulations for all wildlife

projects and eliminating all trespass grazing by livestock (cattle), goats, and burros and constructing fences where trespass is a problem.

Lechuguilla-Mohawk Habitat Management Plan

The BLM and the AGFD 1997 Lechuguilla-Mohawk HMP covers wildlife improvement projects on approximately 930,000 acres of public land, including BMGR—West and public lands to the north and west of BMGR—West. The plan objectives include maintenance and enhancement of habitat for Sonoran pronghorn, desert tortoise (Sonoran population), flat-tailed horned lizard, mule deer, desert bighorn sheep, upland game, nongame, and other sensitive wildlife habitat. Specifically, the plan identifies seven new permanent wildlife water sources to be constructed in the Copper, Gila, Mohawk, and Tinajas Altas mountains (six within range boundaries and one outside range boundaries) and four existing wildlife water sources in these mountains to be maintained and improved. Presently, five of the waters have been constructed.

Draft Barry M. Goldwater—East Habitat Management Plan

The BLM, in cooperation with the AGFD and Luke AFB, prepared the Draft Barry M. Goldwater—East HMP in 1999. The HMP covers BMGR—East (using the Mohawk Mountains as the dividing line between BMGR—East and BMGR—West) and the Sand Tank Mountains area that was not included in the BMGR land withdrawal with the MLWA of 1999. This document did not go beyond the draft stage and some of the plan objectives potentially may have been revised had the plan been completed for implementation. Objectives of the plan include maintenance and enhancement of habitat for Sonoran pronghorn, lesser long-nosed bat, cactus ferruginous pygmy-owl, desert tortoise (Sonoran population), desert mule deer, and desert bighorn sheep. Fifteen new high-elevation water developments for desert bighorn sheep and white-tailed deer were proposed, along with five new low-elevation water developments for mule deer, javelina, and Sonoran pronghorn. A total of 15 of these proposed water developments are within BMGR—East. In addition, the plan proposed redevelopment or scheduled maintenance for 19 of the 32 existing water developments. Of the 19 water developments proposed for redevelopment or maintenance, 13 of the waters are within BMGR—East.

4.6.3.3 Game Species Management Actions

Wildlife found on the BMGR that are considered big game by the AGFD include mule deer, white-tailed deer, javelina, bighorn sheep, and mountain lion. Small game mammals that occur on the BMGR include the desert cottontail and black-tailed jackrabbit. Game birds occurring on the BMGR are the mourning dove, white-winged dove, and Gambel's quail. The BMGR is within the boundaries of two state game management units, 40A and 40B. Unit 40A

encompasses that part of the range east of State Route 85 and additional areas outside the BMGR, while 40B lies west of State Route 85 and the majority of lands that comprise this unit are BMGR lands.

AGFD is required by statute to establish programs for the management of game species for both hunters and non-hunters. As documented in *Wildlife 2006,* the AGFD's wildlife management program strategic plan for the years 2001-2006 (AGFD 2001b), the demand for Arizona's game resources generally exceeds the supply. Regulation of the annual harvest requires an inventory of the game resource and an estimate of the harvest of each species. These data constitute basic information needed to formulate hunting harvest limits and season lengths. The game species seasons and bag limits for huntable species within the Game Management Units 40A and 40B for 2000-2001 is provided in Table 4-17.

TABLE 4-17
2000-2001 GAME SPECIES SEASON AND BAG LIMITS FOR AGFD GAME MANAGEMENT UNITS 40A AND 40B

Species	Rifle or Shotgun	Archery	Muzzle Loader	Bag/ Possession Limits
Big Game				
Any Antlered Deer	3 - 12 Nov	15 - 31 Dec	15 - 31 Dec	1
Bighorn Sheep	1 - 31 Dec			1
Javelina	16 - 22 Feb	1 - 31 Jan		1
Small Game Mammals				
Cottontail Rabbit	1 Jul - 30 Jun			10/20
Jackrabbit	1 Jul - 30 Jun			unlimited
Game Birds				
Mourning Dove	1 - 15 Sep, 24 Nov - 7 Jan			10/20
White-winged Dove	1 - 15 Sep			6/12
Gambel's Quail	13 Oct - 12 Feb			15/30
Predators				
Mountain Lion	1 Jul - 30 Jun			1
Coyote	1 Jul - 30 Jun			unlimited
Bobcat	1 Aug - 31 Mar			unlimited
Foxes (gray and kit)	1 Aug - 31 Mar			unlimited
Furbearers				
Skunks	1 Jul - 30 Jun			unlimited
Badger	1 Aug - 31 Mar			unlimited
Ringtail	1 Aug - 31 Mar			unlimited

Source: AGFD 2000a and AGFD 2000b

This information, used to establish game seasons and bag limits, also provides hunters and non-hunters with a reasonable chance of success in either hunting or observing game commensurate with the available supply and biological welfare of the particular species. It also provides wildlife managers and land administrators data to make decisions to regulate the size of the wildlife resource in balance with available habitat, and to make decisions that affect management of forests and rangelands for multiple users.

Big Game

Big game species on the BMGR include bighorn sheep, mule and white-tailed deer, and javelina. Bighorn sheep, mule deer, and javelina occur throughout much of the BMGR. Mule deer and javelina numbers generally increase from west to east across the BMGR and are probably most abundant in the eastern one third of the range. White-tailed deer are present in limited numbers in the Sand Tank Mountains. Although the mountain lion is considered by AGFD as a big game species, it will be treated here under Predators and Furbearers.

Data on big game species on the BMGR are compiled by AGFD. However, not all areas are surveyed annually and previous years data are often combined with other hunt units, thus making description of game survey and harvest information problematic. While AGFD maintains records of numbers of some species taken in the two game management units, data on population trends and take levels for each species are not available.

On the BMGR, AGFD, with support from non-governmental organizations such as the Arizona Desert Bighorn Sheep Society and the Yuma Valley Rod and Gun Club, has been the primary proponent for developing, monitoring, and maintaining wildlife water developments as habitat improvement projects for big game species, principally bighorn sheep. This practice has become controversial and is addressed separately in Section 4.6.4.

Bighorn Sheep: Current management for this species on the BMGR consists of provision of supplemental water developments, aerial surveys, and a regulated hunt. Recent concerns over population declines of bighorn sheep in the Sauceda Mountains precipitated an effort by AGFD to determine causes of mortality. During November 1993, 46 bighorn were translocated to the Sauceda Mountains. Thirty of these animals were fitted with radio collars and monitored weekly to monthly until April 1998. After 4.5 years, 9 of 30 radio-collared animals were still alive. Of the 21 other animals, 11 were probably or possibly killed by mountain lions, 2 were probable victims of sinusitis, 7 died of unknown causes, and 1 had an early radio failure (AGFD 1999a).

The *Wildlife 2006* strategic plan's goal for this species is to increase bighorn sheep populations and provide diverse recreational opportunities. Applicable species-specific strategies outlined include:

- Use population modeling to assist in permit recommendations. Base management on population characteristics, herd units, and habitat potential.

- Establish self-sustaining populations at all new transplant sites.

- Provide hunter recreation that stresses the quality of the hunting experience and harvest of older age class rams.

- Cooperate with land management agencies, property owners, and lessees to reduce adverse interactions between bighorn sheep, feral animals, and domestic livestock.

- Manage and enhance habitats, specifically including development of new and maintenance of existing water catchments, through partnerships with public agencies, property owners and lessees, and wildlife conservation organizations.

Mule Deer: The *Wildlife 2006* goal for this species is to maintain populations at levels that provide diverse recreational opportunities. Applicable species-specific strategies outlined include the following:

- Use standardized surveys and population and hunt modeling to assist in permit recommendations. Base harvest objectives on population targets and habitat objectives.

- Issue permits considering hunter access and demand rates for various weapon types.

- Improve the condition of declining or low density herds through habitat improvement, research, conservative hunt management, or predator management.

- Coordinate with land management agencies, property owners, and lessees to mitigate land uses that are detrimental to mule deer.

- Manage and enhance habitats through partnerships with public agencies, property owners and lessees, and wildlife conservation organizations.

Javelina: The *Wildlife 2006* goal for this species is to maintain populations at levels that provide diverse recreational opportunities, while minimizing substantiated depredation and nuisance complaints. Applicable species-specific strategies outlined include the following:

- Issue permits in consideration of demand rates for various weapon types.

- Manage and enhance habitats through partnerships with public agencies, property owners and lessees, and wildlife conservation organizations.

Small Game Mammals

Small game mammals that occur on the BMGR include the desert cottontail and black-tailed jackrabbit. The antelope jackrabbit occurs to a limited extent in the BMGR. Data on relative abundance of these species on the range are absent. The time-intensive nature of survey methods required to collect quality data has prohibited survey for these species. However, these species should be reported in the bag of all hunters. For most small game species, AGFD's *Wildlife 2006* strategic plan notes that supply is not quantified because the breeding populations are unaffected by hunting. The plan does commit the AGFD to monitoring the response of small game species to hunting, however, and will restrict hunting pressure if hunting is found to adversely affect breeding populations. There is a general strategic plan for cottontail rabbits (three species of cottontail rabbits occur in Arizona, only the desert cottontail occurs on the BMGR).

Cottontail Rabbits: Maintain or enhance cottontail hunting opportunity by improving access to existing habitat, coordinating with other agencies to improve habitat, and protecting primary cottontail habitat from development. The AGFD *Wildlife 2006* strategic plan includes the following species-specific strategy for cottontail rabbits:

- Enhance hunter opportunities in proximity to metropolitan areas.

Game Birds

Game birds occurring on the BMGR are the mourning dove, white-winged dove, and Gambel's quail. Of these, the Gambel's quail is probably the most frequently hunted on the BMGR. No quantitative data exist on hunting pressure, population levels, or trends of this species on the BMGR, however observations indicate that populations of these game birds are healthy and occur throughout much of the Range.

Doves: Mourning doves occur as permanent and wintering populations while white-winged doves are known only as spring/summer residents. Timing of white-wing arrival coincides with the flowering of saguaro cacti, their primary food/foraging source, in early to mid April. White-wings depart for Mexico and Central America usually by early September.

The USFWS is the agency responsible for determining baseline population levels of mourning and white-winged doves. Currently, there are two permanent call count transects located on the BMGR, but these have apparently not been run in recent times. The AGFD *Wildlife 2006* strategic plan goal for doves is to maintain or enhance populations of white-winged and mourning doves as important parts of Arizona's fauna while providing recreational opportunity to as many individuals as possible. This requires promoting land management practices that

benefit wildlife, and either conducting or supporting research in areas where additional information is needed. The following species-specific strategies for doves from the AGFD *Wildlife 2006* strategic plan may be applicable:

- Maintain existing population surveys, including the annual Call Count Surveys
- Continue developing a program to involve public and private farmers in planting food plots and nesting habitats
- Implement hunt structures that maintain and enhance dove populations. When populations have recovered to allow for additional harvest, bag limits and seasons should be liberalized. The framework recommendations should be specified in the Pacific Flyway Management Plan for the Western White-winged Dove
- Improve dove populations through management agreements or land purchases to retain quality nesting and feeding habitat

Quail: Gambel's quail are found mainly in association with washes and in paloverde-mixed cacti habitats. Quail populations fluctuate with winter rainfall since availability of succulent green foods is a natural limiting factor (Brown 1989). There are currently no standardized procedures in place for monitoring quail populations on the BMGR. Given the relatively light hunting pressure on quail populations, as indicated by the overall numbers of recreation permits issued and the relatively small area open to hunting, it is unlikely that hunting has a noteworthy impact on the population present on the BMGR. The AGFD *Wildlife 2006* strategic plan state-wide goal for this species is to maintain or enhance current levels of Gambel's quail hunting opportunity by improving access to existing habitat, and coordinating with other agencies to improve habitat and protect primary Gambel's quail habitat from development. The following species-specific strategies from the AGFD *Wildlife 2006* strategic plan may be applicable:

- Develop standardized surveys to inventory populations and evaluate existing habitat
- Coordinate with land management agencies to ensure that livestock grazing of quail habitat is within allowable-use guidelines that provide quail with adequate food and cover
- Collect data to estimate demand and harvest more accurately
- Develop species-specific objectives for Gambel's quail

Predators and Furbearers

Five species of predators are known to occur on the BMGR—the kit fox, gray fox, coyote, bobcat, and mountain lion. All of these are also classified as predators by the AGFD, except for the mountain lion, which is considered a big game animal. For the purposes of this plan, the mountain lion will be considered with other predators to facilitate construction of management actions that will apply to all predators. Although not taxonomically substantiated, a subspecies of the mountain lion, the Yuma puma, is purported to exist in BMGR—West. This subspecies is listed as a Wildlife of Special Concern by the AGFD (see Section 4.7).

The AGFD Predation Management Policy establishes guidelines for implementing site-specific mountain lion and coyote management through sound biological practices with public involvement. To implement this policy, the AGFD will develop site-specific management plans when either of these two species is considered to be inhibiting the ability of the AGFD to attain management goals and objectives for other wildlife species as outlined in the *Wildlife 2006* strategic plan. Site-specific management plans will be consistent with the management goals and objectives for the predator species involved, other species, the habitat, and other biological, social, and legal constraints. Management actions to reduce mountain lion or coyote predation will be:

- Confined to site-specific areas
- Directed toward offending animals or populations
- Initiated after approval of a site-specific management plan

Mountain lion and coyote management may occur in, but is not limited to, the following circumstances:

- In site-specific areas where introductions or transplants of vulnerable wildlife species (e.g., bighorn sheep, pronghorn antelope, or special status species) has occurred or is imminent. Management actions should be intensive and of sufficient duration and frequency to allow transplanted animals and their progeny to become established and self-sustaining
- Where wildlife populations are below management objectives and where there is evidence that predation may be a factor

Site-specific management plans should consider the feasibility of non-lethal methods. The AGFD will promote habitat management activities on public and private lands that could limit predator impacts. Once the decision has been made that mountain lion or coyote removal is necessary, the following methods should be considered:

- Licensed and permitted hunters or trappers may take mountain lions or coyotes during established seasons. Commission rules and regulations may be modified to promote an increased sport harvest.

- AGFD-designated individuals may remove a specified number of mountain lions or coyotes in site-specific areas where wildlife concerns have been identified. This action may include the use of aerial gunning.

- AGFD personnel may remove a specified number of mountain lions and coyotes in site-specific areas where wildlife concerns have been identified.

Mountain Lion: The *Wildlife 2006* goal for mountain lion is to manage the mountain lion population, its numbers and distribution, as an important part of Arizona's fauna and to provide mountain lion hunting (including hunting with dogs) and other related recreational opportunities. AGFD's harvest objective for 40B is one mountain lion per year, although no mountain lions have been taken in this area in recent years (Engel 2002b). Applicable species-specific strategies outlined include the following:

- Maintain a complete database from all harvest sources, through a mandatory check-out system, including age, sex, kill location, etc. to index population trend

- Conduct a hunter questionnaire biannually

- Evaluate the management implications of population and relative density estimates

- Implement hunt structures to increase and direct harvest emphasis toward areas with high lion populations, and where depredation complaints are substantiated, and evaluate the effectiveness of these efforts

- Determine population numbers and characteristics on a hunt-area basis

- Increase public awareness of mountain lions and their habits, to reduce conflicts with humans

- Implement the AGFD Predation Management Policy

Five furbearer species (spotted skunk, striped skunk, hooded skunk, badger, and ringtail) also occur on the BMGR. Although data on numbers of animals taken from each management unit are reported annually by AGFD, data on population size, age distribution, and sex ratio are important for establishing baseline data on animal population trends and for making management decisions. The AGFD *Wildlife 2006* strategic plan goals for predators and furbearers are to

maintain the historical range and distribution of furbearers and predatory mammals in Arizona and to allow for maximum recreational, economic, and aesthetic uses commensurate with existing populations. Applicable species-specific strategies outlined include the following:

- Encourage the public to respond to depredation situations, within the limits established by ARS 17-239
- Continue to obtain estimates of hunter harvest of predators and furbearers
- Maintain adequate suitable habitat for predators and furbearers
- Through surveys and research, develop information regarding range, distribution, population levels, and harvest opportunities for predators and furbearers
- Implement the AGFD Predation Management Policy

4.6.3.4 Wildlife Water Developments

Managed Waters Within and Near the BMGR

Over the past few decades, many of the natural surface water catchments have been modified and many artificial catchments have been created to retain ephemeral runoff for wildlife. These include natural tinajas (cavities or depressions, usually in exposed bedrock) and sand tanks (saturated sand depressions) that have been modified by excavation or damming, troughs or guzzlers (wells piped to drinkers), charcos (manmade water reservoirs within adobe flats and washes), and parabolic collectors (permanent self-filling artificial catchments that collect rain using aprons or bowl-shaped devices with storage tanks feeding drinkers). Enhancement strategies include shade roofs over open tanks to reduce evaporation and retard algae growth, gabion silt dams to retard sedimentation buildup, and collection in confined tanks for valved release (Broyles 1997). The Tinajas Altas tanks area remains largely unmodified; however, small steps have been constructed at two of seven natural rock tinajas to ensure that wildlife can escape during low water levels. The 43 surface waters within the BMGR that are actively maintained for wildlife are listed in Table 4-18.

TABLE 4-18
DEVELOPED WATERS MANAGED FOR WILDLIFE WITHIN THE BMGR

Name	AGFD No.	Location	Type of Development	General Elevation	Construction Date
BMGR—East					
Sand Tank Mtn. #3	499	Sand Tank Mountains	A	Low	4-15-58
Sand Tank Mtn. #4	500	Sand Tank Mountains	A	Low	4-27-58
Sand Tank Mtn. #7	637	Sand Tank Mountains	A	Low	3-30-63
Sand Tank Mtn. #8	638	Sand Tank Mountains	A	Low	4-10-63
Sand Tank Pothole #1	635	Sand Tank Mountains	DN	Low	3-1-63
Sand Tank Pothole #2	794	Sand Tank Mountains	A	High	2-14-72
Juniper Tank	949	Sand Tank Mountains	A	High	2-21-87
Dragon's Tooth	961	Sand Tank Mountains	A	High	3-5-88
Sauceda Mtn. #1	578	Sauceda Mountains	A	Low	4-19-61
Sauceda Mtn. #2	579	Sauceda Mountains	A	Low	5-16-61
Sauceda Mtn. #3	580	Sauceda Mountains	A	Low	5-30-61
Sauceda Mtn. #4	581	Sauceda Mountains	A	Low	5-29-61
Sauceda Mtn. #5	582	Sauceda Mountains	A	Low	6-27-61
Sauceda Mtn. #6	583	Sauceda Mountains	A	Low	6-29-61
Sauceda Mtn. #7	584	Sauceda Mountains	A	Low	7-6-61
Sauceda Mtn. #8	585	Sauceda Mountains	A	Low	7-12-61
Sauceda Cave Pothole	675	Sauceda Mountains	DN	High	4-11-65
Thanksgiving Day Tank	778	Sauceda Mountains	DN	High	5-1-71
Holt's Hole	789	Sauceda Mountains	DN	High	3-1-72
Black Bottom	795	Sauceda Mountains	DN	High	3-7-72
Black Tank	813	Crater Range	DN	High	2-1-77
Halliwill	936	Childs Valley	A	Low	5-1-86
Eagle Tank	634	Aguila Mountains	DN	High	3-31-63
Thompson Tank	636	Aguila Mountains	A	Low	3-31-63
Don Diego Tank	803	Aguila Mountains	DN	High	
BMGR—West					
Major Tank	865	Copper Mountains	DN	High	3-21-82
Coyote Peak Tank	893	Copper Mountains	DN	High	2-19-84
South Copper Mountain	N/A	Copper Mountains	A	High	5-16-98
Betty Lee Cistern	200	Copper Mountains	A	High	7-15-51
Dominy Pothole	862	Mohawk Mountains	DN	High	2-21-82
Mohawk Mtn #1	863	Mohawk Mountains	A	High	2-24-82
Mohawk Mtn. #2	864	Mohawk Mountains	A	Low	4-29-82
Mohawk Mtn. #3	N/A	Mohawk Mountains	A	Low	5-18-01
Dart Tank	N/A	Gila Mountains	A	High	4-29-95
Sheep Mountain	N/A	Gila Mountains	A	High	1-95
Dripping Springs	235	Gila Mountains	A	High	3-21-52
Cipriano Tank	1042	Gila Mountains	A	High	5-9-93
Geology Divide	N/A	Gila Mountains	A	High	4-17-99

TABLE 4-18
DEVELOPED WATERS MANAGED FOR WILDLIFE WITHIN THE BMGR

Name	AGFD No.	Location	Type of Development	General Elevation	Construction Date
Vopoki Ridge	N/A	Gila Mountains	A	High	4-14-01
Lamb Tank	N/A	Tinajas Altas Mountains	A	High	4-29-95
Ewe Tank	N/A	Tinajas Altas Mountains	A	High	4-29-95
Tinajas Altas	319	Tinajas Altas Mountains	DN	High	
Borrego Tank	962	Tinajas Altas Mountains	DN	High	3-19-88

Notes: DN = Developed natural feature
A = Artificial catchment
N/A = Not available
Sources: U.S. Air Force 1986; BLM Yuma Field Office and AGFD 1997; BLM Phoenix Field Office and others 1999; AGFD 2001a

Wildlife that use managed waters on the BMGR include bighorn sheep, mule deer, white tail deer, coyote, Sonoran pronghorn, javelina; migrant shorebirds and waterfowl; and various other species (Morgart 2002c). Other species recently recorded via remote photography of select wildlife water developments located north of the BMGR include mourning doves, white-winged doves, Gambel's quail, gray fox, bobcat, mountain lion, elf owl, horned owl, other small owls, turkey vulture, and red-tailed hawk (Rosenstock and Rabe 2002) (see Section 4.6.4 for more detail). Of particular interest is the provision of reliable waters for desert bighorn sheep. All water developments are likely to be used by sheep at some time (U.S. Marine Corps 1997). Although the importance of water availability to Sonoran pronghorn is unknown, pronghorn frequent low-elevation water sources on the BMGR and elsewhere (Hervert and others 1995, Hughes 1991, and Morgart 2002c).

Other managed waters in the area that may be used by the same populations of wildlife are located within the Sand Tank Mountains, Batamote Mountains, Gila Mountains, Cabeza Prieta NWR, and Organ Pipe Cactus NM. The AGFD manages five tanks in the Sand Tank Mountains area northeast of East TAC, all of which are low-elevation tanks. They are known as Sand Tank Mountain Catchment Numbers 1, 5, 6, and 9 and Mesquite Well. There are five AGFD managed waters in the Batamote Mountains and four additional AGFD managed waters south in the Ajo Mountains within AGFD Management Unit 40A, south of BMGR—East. There is also one AGFD-managed water in AGFD Management Unit 40B in the Gila Mountains north of BMGR—West. There are 21 additional developed surface waters within the Cabeza Prieta NWR. Some of the surface waters that are actively managed by the USFWS include Papago, a low-elevation water in the Mohawk Valley; Antelope, a low-elevation water in the Agua Dulce Mountains; Jose Juan and Redtail, both low-elevation waters in the Growler Valley; Cameron and Adobe, both low-elevation waters in the Valley of the Ajo; Little Tule, a low-elevation water

in the Little Ajo Mountains; Charlie Bell, a low-elevation water in the Growler Mountains; and Jacks, a low-elevation water in the Growler Mountains (AGFD 2001a). The refuge staff also manages several other high-elevation tanks for wildlife by occasionally hauling water to these tanks and periodically doing maintenance work on them. There are six waters within Organ Pipe Cactus NM that have been improved or developed to some extent, but none of these are actively managed (National Park Service 1997).

There are other natural waters and springs within the BMGR and vicinity that are not managed for wildlife by the AGFD or another agency but may be used by wildlife. Further information regarding these waters can be found in Section 4.3.1.1.

Wildlife Water Maintenance Actions

Most of the AGFD-managed water catchments have been present on the BMGR since about the 1940s and were mostly complete by the 1980s, although a few water catchments have been added since then (see Table 4-18). After initial construction, which is typically accomplished with many volunteers, ongoing AGFD maintenance actions consist of monitoring the condition and water levels; monitoring wildlife use; and enforcing the state requirement that all campsites be more than ¼-mile away from water sources. Occasionally, water may be hauled to wildlife waters when deemed necessary due to wildlife, climactic, or habitat conditions.

4.6.3.5 Recent and Ongoing Surveys and Other Management Actions

Mammals

Although much of the recent and ongoing management activities for mammals is related to protected species such as the Sonoran pronghorn (see Section 4.7.3), the following have been applicable to or focused on general wildlife:

- *Small Nocturnal Mammal Studies:* Intensive survey efforts for small mammals were conducted as part of a study on the effects of military jet overflights on the kit fox and its small mammal prey (Bowles and others 1995). A survey of small mammal populations in relation to the various types of targets was completed during 1998 (Dames & Moore 1998a). No significant statistical differences were found in the numbers of small mammals captured on, adjacent to, or away from target areas. However, due to range scheduling conflicts, the study was not conducted during the optimal time of year so application of the results is limited.

- *Bat Surveys:* A systematic survey of all known mines was started in 1992 (Dalton and Dalton 1994a). Of the 101 sites visited, 11 sites were found to contain bats and an

additional 10 sites were considered important to bats. A follow-up study of the mines in which bats were detected in 1992 was completed in 1997 (Dames & Moore 1997b). Twenty-nine sites were visited during the summer reproductive season (May to July) and winter (November to February). Bats were found in 16 of 19 sites identified by Dalton and Dalton (1994a) and in several additional sites not previously examined.

A separate survey was conducted to focus on locating natural roost sites throughout the Sand Tank and Sauceda mountains (Dalton and Dalton 1999). A number of important roost sites of California leaf-nosed bats were found. A radio telemetry study designed to determine home range and habitat use of California leaf-nosed bats in and around the Sand Tank and Sauceda mountains was recently completed (Dalton and others 2000 and Dalton 2001).

- *Arizona Bat Species Priority Matrix*. Some management actions regarding bat species that occur on the BMGR, which are not federally protected or listed in Wildlife of Special Concern in Arizona (AGFD 1996 in preparation), are managed consistent with the *Arizona Bat Species Priority Matrix* (1998). This matrix is intended to provide management agencies and interested organizations and individuals with a means to prioritize conservation actions given limited funding and resources currently devoted to bats. Species ranking of high priority correlates with federal or state listing; thus, these species are addressed in Section 4.7. A species ranking of medium priority indicates a level of concern, but information regarding the species and perceived threats is lacking. A species ranking of low priority indicates that most of the existing data suggest populations are stable, and the potential for major changes in status are unlikely. Bat species documented to occur on the BMGR and ranked as medium priority include cave myotis (also included in TNC's bat guild species conservation element), western mastiff bat, and Underwood's mastiff bat; those of low priority include California myotis, western pipistrelle bat, big brown bat, pallid bat, and Mexican free-tailed bat.

- *Fencing and Posting Mines.* Surveys for bats have delineated many abandoned mines throughout the BMGR. Most mines are clustered at the bases of mountain ranges. During 1997, a program of posting and fencing mines was initiated. All mines visited by Dames & Moore (1997b) were posted with signs approved by the State Mine Inspector's Office. Funds and labor provided by the Air Force and labor provided by the Marine Corps assisted the BLM in the installation of bat-compatible gates on two mines in the Copper Mountains. The effectiveness of any bat gates is being monitored by observing the passage of bats through the gates at different times of the year (at least summer and winter). If necessary, the gates will be altered or removed to continue to allow easy access by bats. Several other mines near high recreational use areas were fenced with barbed wire and posted during 1996 through 1998. Locations of abandoned mines are detailed in Table 4-3.

Birds

- *Small Owl Surveys:* In response to a proposal by the Army National Guard to develop a helicopter gunnery range in the northeast corner of the BMGR (Area A), a study was initiated to collect data on the occurrence of small owls (Chanbers Group, Inc 1995). The primary focus of the study was the cactus ferruginous pygmy owl, then a candidate for listing; however, a considerable amount of data was collected on western screech and elf owls as well. The study encompassed not only the proposed gunnery range but included the Sauceda Mountains area and the East Tactical Range. Three years of baseline data were collected (1994-96) and it was determined that the most efficient times to survey were mid April and/or during a waxing first quarter moon. Abundance of western screech owls declined during the study period while elf owl abundance did not change significantly. This difference was attributed to prey selection, with screech owls selecting small mammals and elf owls relying on invertebrates. Monitoring of the six transects began in 1998 with the intent of bi-annual monitoring, although this was not accomplished (U.S. Air Force 1997d, Dames & Moore 1998b).

- *Diurnal Raptor Nest Surveys:* Large numbers of raptors apparently spend a substantial portion of their non-breeding season on or adjacent to the BMGR. Biological surveys conducted in the mid-1990s in the Sand Tank Mountains, and observations from the few roads that traverse the area, identified more than 100 raptor nests in the area east of State Route 85. More than one third of these nests were active during the 1994 and 1995 breeding seasons (February-June).

- *Neotropical Migratory Bird Study:* This project sought to determine which migrating bird species use the BMGR, determine temporal migratory patterns, and aid in the decision-making process by providing information on how neotropical migratory birds may be affected by Air Force activities. Three years of baseline data were collected in the Sauceda Mountains (1994-96) on three transects with 10 count stations on each transect (University of Arizona 1997). During this initial phase, 110 species of birds were recorded of which 71 percent were breeding or passage neotropical migrants (meaning that they breed in Canada/United States in the summer and migrate to Mexico, Central America, South America, or the Caribbean in the winter). Neotropical migrants were generally more restricted in habitat requirements than resident species and showed a strong association with overstory mesquite and paloverde. Three additional transects were established and monitoring of the six transects on a bi-annual basis began in 1998 (Bibles and Harris 1999). Surveys conducted in 1998 were located in or near the Sand Tank Mountains (now mostly part of the Sonoran Desert NM rather than the BMGR). During this survey, 74 bird species were detected. Of these, 74 percent were migratory species and 51 percent were neotropical passage migrants. When compared to the earlier surveys in the Sauceda Mountains, neotropical migrant species richness and bird

abundance was found to be lower in this survey. As the Sauceda Mountains area surveyed had more xeroriparian vegetation than the Sand Tank Mountains area surveyed, this finding supports the theory that xeroriparian vegetation is an important habitat feature for neotropical migratory birds in the Sonoran Desert (Bibles and Harris 1999). Ongoing monitoring of these transects should continue in order to document long-term population fluctuations.

- *Breeding Bird Atlas Surveys*: During spring of 1994, the 56th FW/RMO Natural Resources staff initiated breeding bird surveys in conjunction with the Arizona Breeding Bird Atlas program. Approximately 35 blocks were established on BMGR—East. This program attempted to document which species breed on the BMGR through periodic surveys within each block. A minimum of 25 "quality" hours of observation are required and the process endeavors to confirm breeding for at least 25 percent of all species observed on each block.

Reptiles and Amphibians

- *Reptile and Amphibian Populations*: Through various survey efforts, Couch's spade-foot, Sonoran Desert, great plains, and red-spotted toads are known to occur in various places on the BMGR, especially in the vicinity of tinajas, catchments, and flooded mine tunnels. Six species of rattlesnakes (diamondback, Mohave, speckled, black-tailed, tiger, and sidewinder) have been confirmed to occur on the Range (Barry unpubl. data). In addition, Cowle's fringe-toed lizard occurs on the Mohawk Sand Dunes and other sandy areas throughout the BMGR (Turner and others 1997). In a broad-spectrum survey of sensitive species, Dames & Moore (1996) documented occurrence of Gila monster, chuckwalla, and red-backed whiptails on the BMGR (where possible). In addition, field notes included in their 1994 desert tortoise (Sonoran population) surveys include observations of various reptile species encountered (Dames & Moore 1994).

4.6.3.6 Exotic, Invasive, or Noxious Species Management

Although the Goldwater Amendment includes plans to inventory the burro population to determine herd size and ownership, prepare a burro capture-and-removal plan, and adopt or impound and sell captured burros, no actions have been taken to inventory or manage the wild burro population that occurs in BMGR—East.

In 1992, the Air Force provided funds to the BLM to install fences along the north boundary to prevent access onto the BMGR by cattle on the Big Horn allotment, which was adjacent to the Sand Tank Mountains portion of BMGR—East that was not renewed with the 1999 MLWA.

4.6.4 Information Not Currently Available to Support General Wildlife and Wildlife Habitat Resource Management

The current lack of some existing data or information poses potential challenges for the future management of general wildlife and wildlife habitat resources within the BMGR. This currently unavailable information was identified during the preparation of the affected environment section of this EIS. It does not constitute incomplete or unavailable information needed to conduct the environmental impact analysis presented in Chapter 5 in accordance with 40 CFR §1502.22. Although additional wildlife and wildlife habitat resource information needs may be defined in the future, those identified in this document include:

- *Wildlife Habitat Impacts.* The extent to which military and non-military land use and UDA traffic within the BMGR disturbs the habitats of some individual wildlife species has not been quantified on a site-specific basis.

- *Desert Tinajas.* The locations and characteristics of desert tinajas within the BMGR have not been inventoried or mapped on a comprehensive range-wide basis. Hall and others (2001) report that comprehensive data are also currently unavailable on the occurrence and distribution of invertebrates species and on aquatic community dynamics in natural versus modified tinajas.

- *Amphibians.* The Sonoran Desert toad, red-spotted toad, and Couch's spadefoot may compete for available natural and human-developed water sources on the BMGR and were identified as the ephemeral water-breeding guild. Hall and others (2001) report that no data are currently available on the relative usage, as well as co-usage, of different water sources on the BMGR by members of this guild. Information on dynamic species interactions under different water regimes (i.e., playa versus tinaja; ephemeral versus permanent water; modified tinaja versus natural tinaja) is also unavailable.

- *Reptiles.* A general inventory of the occurrence, distribution, and population viability of reptile species throughout the BMGR has not been completed. In addition, no monitoring program has been established to track fluctuations in the distributions and viability of reptile species, including key species such as the desert tortoise (Sonoran population) and Gila monster.

- *Invertebrates.* Information on the occurrence and distribution of invertebrate species on the BMGR is limited. Hall and others (2001) report that even a cursory sampling of each natural community for invertebrates would be informative as to the relative species richness, evenness, and ecological importance of these species on the BMGR.

- *Game Harvest Data.* AGFD has adequate data to manage game species, but the data are organized by game management unit and are not specific to the BMGR. In particular, the date, location, method of take, sex, and age class of wildlife species taken by hunters on the BMGR, including deer, javelina, doves, quail, predators, furbearers and rabbits, are not specifically documented.

- *Quail Evaluation Procedures.* General quail survey and habitat evaluation procedures may not be providing data that reflect the true conditions of this species and its habitat within the BMGR.

- *Predators and Furbearers.* Existing data on the range, distribution, den sites, population levels, and harvest of predators and furbearers may not reflect the true conditions of these animals and their habitat or harvest opportunities within the BMGR.

- *European Starlings.* Hall and others (2001) report that the occurrence, abundance, and spread of European starlings and the potential impact of these species on the nesting dynamics of the native secondary cavity nesters are not well understood.

- *Wild Burros.* Casual reconnaissance information verifies that wild burros are present within BMGR—East, particularly in Management Units 6 and 7. No survey data are currently available, however, that reliably report the abundance and distribution of these animals within the range or the impacts that this non-native species may be having on native wildlife and habitats.

- *Trespass Livestock*. Casual reconnaissance information verifies that trespass livestock are at least periodically present within BMGR—East, particularly in Management Units 6 and 7. No data are currently available, however, that reliably report the occurrence, cause, and ownership of trespass livestock.

- *Wildlife Movement Corridors.* Hall and others (2001) report that important corridors for movement of terrestrial and avian wildlife within and from areas adjacent to the BMGR have not been identified or characterized.

- *Kit Fox*. Kit fox has been identified by TNC as a species conservation element for the BMGR. Hall and others (2001) report that no data is currently available that characterizes the occurrence of kit foxes within the BMGR, including the size of kit fox home ranges, how these home ranges change with habitat conditions, and if kit foxes and/or their prey are vulnerable to vegetation changes caused by invasive species.

- *Le Conte's Thrasher*. Le Conte's thrasher has been identified by TNC as a species conservation element for the BMGR. Hall and others (2001) report that the data currently available does not characterize preferential use areas of Le Conte's thrashers

within creosotebush flats, effects of invasive plant species or pesticide usage effects on the prey base, their specific food and water requirements, or structural requirements of their occupied/unoccupied habitats. These authors also report that data on the factors that determine territory/home-range size, barriers to dispersal, habitat restoration requirements, effects of drought on their prey base, and population are also unavailable for these birds.

- *Reptile Guild*. The valley bottom reptile guild has been identified by TNC as a species conservation element for the BMGR. Hall and others (2001) report that no data are currently available that characterize the occurrence of this guild within the Valley Bottom Floodplain Complex Natural Community.

- *Cowle's Fringe-Toed Lizard*. The Cowle's fringe-toed lizard has been identified by TNC as a species conservation element for the BMGR. Hall and others (2001) report that no data are currently available that characterize the range of this species or the potential distinct taxonomic status or genetic viability of the fringe-toed lizard population in the Mohawk and San Cristobal valley dunes.

In addition to the aforementioned information needs, there are many questions regarding the ecological value and effects of existing and future wildlife water developments within the BMGR. These questions address some areas of substantial management controversy. Answers to key questions regarding the wildlife water development issue will not be available until additional research and evaluations are completed following the implementation of the INRMP for the BMGR. In accordance with 40 CFR §1502.22, the unavailable information on wildlife waters does not constitute incomplete or unavailable information needed to identify significant adverse impacts relevant to making a reasoned choice among alternatives for the proposed INRMP.

Background Information. It has long been assumed that the availability of free-standing water is a key limiting factor on wildlife populations in arid habitats. The wildlife water development program, initiated in the 1940s and 1950s throughout the western United States, was born of this assumption and attempts by resource managers to benefit game species and other wildlife (Rosenstock and others 1999). Water developments essentially mimic the free-standing water that occurs naturally in the form of potholes. Developed waters marginally increase the density of water over a large area. On the BMGR and the adjacent Cabeza Prieta NWR, wildlife water developments were created primarily for the benefit of bighorn sheep, deer, and, later, Sonoran pronghorn by the AGFD and USFWS after the establishment of the refuge and military range in 1939 and 1941, respectively (Broyles 1997). Ranchers and range managers also developed water resources for livestock in the region before the refuge and military range were established, but only a few of these waters continue to be available for use by wildlife.

More recently, wildlife water developments have received critical scrutiny as the need for the continued development of new water sources has been questioned (Sanchez and Haderlie 1990). Critics have suggested that wildlife water developments have not yielded expected benefits and may negatively impact wildlife by increasing predation, competition, and disease transmission (Broyles 1995, Brown 1998). These critics regard the understanding of both positive and negative effects of wildlife water developments as substantially incomplete. Although the water developments have long been thought to benefit desert bighorn sheep populations, there are cases where bighorn sheep reside in ranges without water, survive droughts, and ignore water during times of heat stress (Broyles 1998, Brown 1998). Most extensive reviews of the available literature have concluded that desert bighorn sheep appear to have benefited from water developments in some, but not all areas (Ballard and others 1998, Krausman and Czech 1998, Rosenstock and others 1999, Gun 2000). Benefits to other target species (mule deer, white-tailed deer, upland game birds) and non-targeted species (mammalian predators, small mammals, birds, and herpetofauna) have also been documented (Ballard and others 1998, Rosenstock and others 1999). Some low-elevation waters may benefit Sonoran pronghorn and are the subject of some recovery efforts (Hervert and others 1995; Hughes 1991). (see Section 4.7.3 for more details). It has been suggested that modifications to natural tinajas may be detrimental to non-targeted endemic flora and fauna. For example, addition of water has allowed non-native honey bees to colonize arid regions where they were previously excluded and may contribute to the spread of the Africanized honey bee and/or result in competition effects on native honey bee populations (Broyles 1995, Rosenstock and Rabe 2002). The limnology of natural tinajas and invertebrates present in natural tinajas are poorly understood, and questions remain about how modification of intermittent or ephemeral water sources to perennial water sources affects seasonal chemistry, cycles of flora and fauna, and water quality. Economic costs and benefits of wildlife water developments have also been challenged (Broyles 1998). Because many of the early waters were developed without adequate site or area analysis, and some were added after only a precursory study, much knowledge about wildlife has been lost. The planning process still lacks detailed pre- and post-surveys of populations in the area (Broyles 1998). Questions remain as to how resident and migrating species use waterholes; how far species move to water; and how developments affect the area's targeted and non-targeted species, population distributions and stability, and overall ecology.

Rosenstock and others (1999) offers the most comprehensive review of scientific literature on the benefits and impacts of wildlife waters in the Western United States and Arizona to date. Schmidt and DeStefano (1999) offers important baseline data for the BMGR. In this study, the researchers recorded bat use, conducted predator surveys, recorded amphibians and other vertebrates, measured water quality indicators, and identified macroinvertebrates at water sources on the Cabeza Prieta NWR and BMGR.

The controversy, particularly as it pertains to wildlife water developments on the BMGR, concerns: (1) whether developments are necessary for wildlife, (2) what effect developments might have on populations of non-target animals (such as predators) and (3) the development of

additional wildlife waters. Each of these is addressed below, drawing from Rosenstock and others (1999) unless otherwise indicated.

Are Wildlife Water Developments Necessary for BMGR Wildlife? Surrounding land use has likely reduced wildlife access to historic water sources adjacent to the range. For example, Interstate 8 north of the range and Highway 2 south of the range restrict access to water in the Gila and Sonoyta rivers, respectively. The anticipated effects of the provision of additional wildlife water sources are expanding wildlife distribution, increasing productivity, reducing mortality, and increasing fitness. Wildlife that may use open water on the range include bighorn sheep, deer, coyote, pronghorn, javelina; migrant shorebirds and waterfowl; and various other species.

Effects on game species evaluated in Rosenstock and others (1999) applicable to the BMGR include upland game birds, desert bighorn, mule deer, white-tailed deer, and mammalian predators; non-game species include small mammals, birds, and herpetofauna as follows:

- *Upland Game Birds.* Gambel's quail can meet most of their water needs by consuming succulent foods, but require drinking water to survive periods of sustained heat and drought. Quail use wildlife waters, particularly during hot, dry periods and quail distribution and abundance has increased with water developments in some areas. Water developments are most beneficial to quail in areas characterized by drought during the spring-summer breeding season. Mourning doves and white-winged doves require surface water, have been observed using water developments in Arizona, and have probably benefited from water developments on the BMGR.

- *Desert Bighorn.* Water is considered a key habitat requirement of desert bighorn. Surface water is readily used by desert bighorn, but populations persist in areas where open water is lacking on a seasonal or permanent basis. Water developments have been a centerpiece of desert bighorn sheep habitat management throughout the arid West. Use of water developments by desert bighorn sheep is well documented, but some catchments intended to benefit sheep have received little or no use.

- *Mule Deer.* Mule deer rely on perennial open water to support their existence. Mule deer typically are found in close proximity to and are frequent users of water sources, particularly during dry periods. There is good evidence that water developments have benefited mule deer in arid Southwestern habitats, increasing occupancy of habitats, deer densities, and mule deer harvest in areas where water had been limited.

- *White-tailed Deer.* Habitat use by white-tailed deer in the Southwest is closely tied to the availability of free-standing water. Water developments have likely benefited white-tailed deer populations in the Southwest. Availability of supplemental water may increase fawn survival and recruitment when forage moisture is low.

- *Mammalian Predators.* Existing literature is equivocal. Most predators can obtain needed moisture from their prey and some species are believed not to require free water (e.g., kit fox and ringtails). There are many observations of predators drinking from developed wildlife waters. There is also evidence that water developments attract predators; however, the effects on predator and prey populations are unknown.

- *Small Mammals.* Small terrestrial mammals are relatively unaffected by wildlife water developments. Bats are strongly attracted to water sources and use water developments for drinking and foraging (i.e., insectivorous bats). Water developments probably have expanded the distribution of some bats species that are dependent on surface waters.

- *Birds.* Water developments are frequently used by many bird species including passerines, shorebirds, and raptors. Migratory birds may use developed waters during migration. Raptors appear to benefit from water developments as the water is used for drinking and bathing and associated structures or vegetation provide perches, nest substrates, and foraging areas with concentrations of potential prey. Harris' hawks require free-standing water during the breeding season, and water developments have allowed population expansion into previously unoccupied Sonoran Desert habitats.

- *Herpetofauna.* Studies have generally reported that water developments did not affect reptile abundance or species richness. However, the wandering garter snake opportunistically inhabits aquatic habitat provided by stock tanks. In Arizona, studies have shown that there are amphibian species that occurred only in stock tanks and other permanent surface waters. Studies in Arizona and New Mexico have found two to four amphibian species at wildlife water developments that were absent at unwatered control plots. Stock ponds and earthen tanks represent the bulk of occupied habitats for frog species in the Ranidae Family, which have been widely extirpated from natural habitats.

Rosenstock and Rabe (2002) report on the use of remote time-lapse videotape at three apron-type catchments on Yuma Proving Ground and one improved tinaja in Kofa NWR (all north of the BMGR) to record wildlife use. Between 22 June 2000 and 20 September 2001, the most common visitors to the apron-type catchments were mourning doves, white-winged doves, and Gambel's quail (although these species were not individually counted). Individual counts at these three catchments totaled 6,004 visits from approximately 22 species. Turkey vultures, mule deer, and coyotes, accounted for 29.3, 27.7, and 10.4 percent of these counts, respectively. Horned owls, small owls, bobcat, and gray fox were also observed with regularity. The modified tinaja had the least wildlife visitation with only 45 recorded visits, which included 25 visits from gray fox, nine from desert bighorn sheep, seven from bobcat, one from a mountain lion, one from a badger, one from a coyote, and one from a mule deer. Smaller-sized wildlife species were doubtlessly under-represented in the sample because they were less likely to be identified. Both yearly and seasonal differences in wildlife visitation were observed.

Although not examined in detail in Rosenstock and others (1999) and only briefly discussed in Rosenstock and Rabe (2002) in terms of predation, consideration of the necessity of wildlife water developments for Sonoran pronghorn is a particularly important wildlife water management issue for the BMGR. Sonoran pronghorn use of water is not fully understood. Sonoran pronghorn occur in areas with little or no permanent drinking water and have adapted to living with low quantities and infrequent access to drinking water, relying mostly on preformed (i.e., obtained from forage) and metabolic water (Lee and others 1998). Phelps (1981) and Hughes (1991) reported no evidence of water use, even when available. Wright and deVos (1986) and Hughes (1991) report average distances of more than 5 kilometers (km) between Sonoran pronghorn and water sources, with no statistically significant differences between dry and wet seasons. However there has been increasing documentation of water use from natural and man-made water sources, including ephemeral rainwater collected in a high-explosive bomb crater at the BMGR (Hervert and others 1995) and use of emergency water tubs placed in areas of Sonoran pronghorn activity on the Cabeza Prieta NWR during the summer of 2002 (Morgart 2002b). Most water sources may go unfrequented by Sonoran pronghorn because of their location away from favored seasonal foraging areas or because the presence of significant brush at some locations might work to the advantage of Sonoran pronghorn predators. The Sonoran pronghorn forage enhancement project, which is starting to be implemented, proposes the addition of free-standing water in food plots. More details regarding Sonoran pronghorn are provided in Section 4.7.

What Effect Might Water Developments Have on Non-Targeted Animals? Four potential adverse impacts commonly cited and examined in Rosenstock and others (1999) include predation, competition, direct mortality, and health problems resulting from poor water quality or disease transmission. The evidence supporting these contentions, as analyzed in Rosenstock and others (1999) is as follows:

- *Predation.* Predators (foxes, coyotes, and bobcats) are common throughout the BMGR, including areas without available water. Kit foxes are independent of free-standing water (Golightly and Ohmart 1984); therefore, their distribution and abundance may be influenced by, but not dependent on, water. Shaw noted the abundance and generally wide distribution of bobcats on the BMGR (Shaw and others 1988). Bobcats are likely able to obtain their water requirements from the prey items they select. Little physiological work exists for coyotes, although they are frequently observed great distances from available water. The concept of developed waters becoming predator concentration areas is valid. Mountain lions are known to stalk prey around water sources, where conditions are favorable (i.e., areas of thick cover and/or nearby rock ledges). This is as true of natural waters as it is of artificial ones. It can also be assumed that this is more prevalent where free-standing water is limited and prey species are more concentrated than in areas where water is more available and prey species are dispersed. In general, however, it appears that predator populations are independent of

water and, based on current literature, this remains an untested hypothesis. (A Sonoran Pronghorn Recovery Team study is currently being conducted to determine behavior and seasonal movements of coyote relative to Sonoran pronghorn locations, free water, rainfall events and may provide some applicable data.)

- *Competition.* There is concern that water developments may exacerbate competition, particularly among native and exotic ungulates. Feral burros are strongly attracted to water developments. In some areas, water developments have increased abundance of deer and burros, perhaps creating competition with desert bighorn for a limited forage base. The influence of water developments on competitive interactions among ungulates has not been directly studied. Thus, based on current literature, impacts remain untested hypotheses. Competition with exotic ungulates is not an issue on the BMGR.

- *Direct Mortality.* Water developments have trapped some animals, causing direct mortality. Birds and small mammal mortalities have been widely reported and mule deer and bighorn sheep have been entrapped in some facilities (most of which are natural waters), prompting the construction of access and escape ramps at some waters. Hunters also harvest game species at water developments. Again, detailed studies about the effects of these mortalities to populations are not available.

- *Water Quality.* In summer, some Arizona catchments have been found to contain potentially toxic algae, bacteria, hydrogen sulfide, and ammonia. Consumption of water-borne toxins has been suggested, but unproven, as a potential explanation for sudden, unexplained sheep die offs. Modification of tinajas can limit flushing during runoff (which may or may not occur with unmodified tinajas) and exacerbate water quality problems. It has been suggested that desert water developments facilitate the transmission of wildlife diseases, but only one documented case was found.

Rosenstock and others (1999) conclude that water developments have benefited some wildlife populations in arid habitats of the western United States. The distribution and/or abundance of popular and economically important game species, including mule deer and white-tailed deer, has increased opportunities for wildlife observation and harvest. Nongame wildlife, particularly birds, bats, and amphibians, benefit. Perceived negative impacts of water developments on wildlife resulting from predation, competition, direct mortality, and disease are not supported by data and remain largely speculative. However, the ecological effects of water developments are inadequately understood and, in some cases, expected benefits to game species and other wildlife have not occurred.

In 1999, AGFD initiated a cooperative, multi-faceted study of the ecological effects of wildlife water development in southwestern Arizona. The study area was north of the BMGR in Yuma Proving Ground, Kofa NWR, and adjacent BLM lands. In January 2002, Rosenstock and Rabe (2002) reported the results to date for components of the project involving some of the issues that

are pertinent to the question at hand including water quality, wildlife diseases, mammalian predators, and native and non-native pollinators. These results are summarized as follows:

- *Water Quality.* Water quality samples were collected from 23 various types wildlife water developments in the study area. The findings were that, in general, water quality met recommended guidelines for domestic and wild animals with the exception of fluoride, which exceeded the suggested maximum on more than one occasion at ten sites (all of which used groundwater). No sites met EPA drinking water standards. All sites were positive for fecal and/or total coliform bacteria. Numerous algae blooms were observed; however, tests of algae samples were negative for cyanobacterial toxins.

- *Wildlife Diseases.* Because biting midges of the genus *Culicoides* are vectors of bluetongue and epizootic hemorrhagic disease, sampling via insect traps was conducted at five wildlife waters. Species of this genus were identified and, although only partial results are available, one tested positive for the presence of bluetongue virus. In addition, blood sample blot cards were distributed to desert bighorn sheep hunters and deer hunters in the study area. Of the 21 blood cards tested, all were negative for epizootic hemorrhagic disease and one was positive for bluetongue. All bighorn sheep samples were negative for both diseases. Finally, a pilot study of water-borne pathogens was conducted at eight water developments. Thus far, neither Trichomonas nor Salmonella species have been identified, although there may be problems with the effectiveness of the available testing being used in this effort.

- *Mammalian Predators.* Several methods of determining coyote abundance in relation to wildlife water developments (i.e., scent posts and scat distribution) were determined to be ineffective methods and no other methodology has been determined to be feasible. Thus, subsequent research has been focusing on coyote habitat use using global positioning system equipped collars to track the animals.

- *Native and Non-native Pollinators.* In June 2000, honeybees were collected from 54 water developments located in the study area. The majority of those collected, 87 percent, were Africanized. Data from March to July identified 1,259 insect specimens belonging to more than 70 species in 12 different families. When all samples are analyzed, 250 to 300 species of pollinator bees are expected to be identified. These additional data are needed to assess the effects of water developments on foraging pollinators.

Should Additional Wildlife Waters be Constructed? The Lechuguilla-Mohawk HMP and Draft Barry M. Goldwater Range East HMP propose the addition of new developed wildlife waters for the BMGR to provide a more optimal arrangement of permanent water for wildlife use. The Lechuguilla-Mohawk HMP identifies seven new permanent wildlife water sources to be constructed in the Copper, Gila, Mohawk, and Tinajas Altas mountains (six within range

boundaries and one outside range boundaries) and four existing wildlife water sources in these mountains to be maintained and improved. Presently, five of the waters have been constructed. The Draft Barry M. Goldwater Range East HMP proposes 20 new water developments—15 high-elevation and five low-elevation water developments. All but five of the proposed new water developments would be located within BMGR—East. Of the 32 existing water developments, 19 are proposed for maintenance or improvement. Thirteen of these are within BMGR—East. Elements of these plans, including wildlife water developments, have been reviewed and incorporated in the alternative management strategies addressed in this EIS (see Table 3-3) and, as such, may be incorporated into the INRMP in accordance with the MLWA of 1999, Section 3031(b)(3)(E)(viii).

Given the high cost of water development, construction, and maintenance, Rosenstock and others (1999) suggest that more should be invested in planning, monitoring, and managing existing facilities. In the past, water developments were considered inherently beneficial to wildlife, wherever they were constructed. Now, many suitable locations for wildlife water developments have been utilized and scarcity of water no longer limits wildlife populations in many areas. Merely adding new water sources to the landscape is no longer adequate justification for new projects. Therefore, these authors recommended that future wildlife water development projects should: (1) have a solid biological basis, (2) reflect clearly articulated management objectives, and (3) include a formal economic benefit/cost analysis. They also recommend that resource management agencies expand formal monitoring of wildlife water developments.

A study on the effects of permanent water on the productivity and recruitment of desert bighorn sheep in the Cabeza Prieta and Sierra Pinta mountain ranges within Cabeza Prieta NWR is currently being developed. Some of the existing wildlife water developments in the Sierra Pinta Mountains may have their water supply temporarily removed for the purpose of monitoring bighorn sheep responses to water removal (Morgart 2002c).

4.7 PROTECTED SPECIES

4.7.1 Existing Conditions

4.7.1.1 Ecoregional Context

Human-caused habitat fragmentation, degradation, and destruction have long since replaced natural factors as the major causes of declines in the numbers of kinds and individuals of naturally occurring animals and plants. Vegetation, habitat, and wildlife population losses inevitably occur as human demands on natural resources expand. Species less tolerant of such impacts become increasingly rare, some to the point of extinction. Federal and state agencies have developed means for the protection of species that are thought to be vulnerable to extinction, most commonly as the result of substantial habitat losses and threats. These agencies

also have developed protective measures for these species aimed at their protection and recovery. In Arizona, the AGFD has identified 116 species as Wildlife of Special Concern in Arizona.

Although the historical occupation of the BMGR by endemic plants and animals is unknown, it is thought that all of the wildlife species believed to be present in 1941 when military use of the BMGR began are still found on the range today. Further, these species are likely present in the same relative numbers as in 1941 (U.S. Air Force 1999). Because the BMGR and much of the surrounding area have remained relatively undeveloped compared to the greater region, the BMGR is increasingly important for the protection and recovery of certain species. Among these, much emphasis has been placed on the federally endangered Sonoran pronghorn and other listed species that are known to be present on the BMGR. This section discusses those species currently protected under federal and/or state law that potentially occur on the BMGR and summarizes existing information about these species. Because of their legally protected status, there are special management implications for these species that are key for consideration in this EIS.

4.7.1.2 Protected Species' Definitions

Protected species are species of plants or animals that, because of their scarcity or documented declining population numbers in the state or nation, have been designated special status for protection and/or management. Regulatory compliance requirements vary based on whether the species are protected under the authorities of the Endangered Species Act, Migratory Bird Treaty Act (MBTA)/Executive Order 13186, Arizona Native Plant Law of 1993, and/or listed as a Wildlife of Special Concern in Arizona. The various types of protected species designations applicable to the BMGR and EIS process are defined herein.

Federally Endangered Species

Federal protection is provided under the Endangered Species Act, for which the USFWS in the Department of the Interior and the National Marine Fisheries Service in the Department of Commerce share administrative responsibilities. The USFWS has primary responsibility for terrestrial and freshwater organisms, while the National Marine Fisheries Service's responsibilities are mainly for marine species. The USFWS is responsible for the federal listing of plant and animal species' on the basis of the best scientific and commercial data available and the species' biological status and threats to its existence. Species federally listed as threatened or endangered, or proposed for such listing, are protected under the Endangered Species Act of 1973, as amended. Section 7 of the Endangered Species Act requires a federal agency to consult with the USFWS if the agency determines that any proposed action may affect a listed species. Categories of species listed under the Endangered Species Act are as follows:

- **Endangered:** Species identified by the USFWS under the Endangered Species Act as being in danger of extinction throughout all or a significant portion of its range.

- **Threatened:** Species identified by the USFWS under the Endangered Species Act that are likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

- **Proposed:** Species identified by the USFWS under the Endangered Species Act that are proposed in the Federal Register to be listed as threatened or endangered.

- **Candidate:** Species for which USFWS has sufficient information on biological vulnerability and threats to support proposals to list them as endangered or threatened.

For some threatened or endangered species, specific geographic areas (whether occupied by listed species or not) that are determined to be essential for the conservation and management of listed species are deemed Critical Habitat. Areas of Critical Habitat have been formally described in the Federal Register.

Migratory Bird Species

Migratory birds are federally protected by the MBTA and Executive Order 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds*, dated 10 January 2001. The MBTA is the domestic law that implements the United States' commitment to four international conventions (with Canada, Japan, Mexico, and Russia) for the protection of a shared migratory bird resource. Each of the conventions protect selected species of birds that are common to both countries (i.e., they occur in both countries at some point during their annual life cycle). The USFWS is the lead federal agency for managing and conserving migratory birds in the United States; regulating the take of migratory birds for educational, scientific, and recreational purposes; and requiring harvest to be limited to levels that prevent over utilization. Executive Order 13186 directs federal agencies taking actions that have, or are likely to have, a measurable negative effect on migratory bird populations to develop and implement a Memorandum of Understanding with the USFWS that shall promote the conservation of migratory bird populations within two years of the date of the order. The order outlines specific requirements of the Memorandum of Understanding and 15 conservation measures that agencies are encouraged to immediately begin implementing, as appropriate and practicable.

Species Listed by the State of Arizona

From the authorities implicit in Arizona Revised Statutes, Chapter 17, the AGFD maintains lists of wildlife species of concern. Wildlife of Special Concern in Arizona cited in this EIS are from a draft AGFD list of Wildlife of Special Concern in Arizona that is pending approval from the Arizona Game and Fish Commission. The list identifies species whose occurrence in Arizona is or may be in jeopardy, or with known or perceived threats or population declines. Wildlife identified in the Wildlife of Special Concern in Arizona is intended to indicate to land management agencies those species that should be emphasized in habitat management from AGFD's perspective (AGFD 1996, in preparation). Many of these species are also federally listed as threatened or endangered.

The Arizona Native Plant Law of 1993 (ARS, Chapter 7, 3-901 et. seq.) is administered by the Plant Industries Division of the Arizona Department of Agriculture. The law identifies protected plants belonging to the following four categories: highly safeguarded, salvage restricted, salvage assessed, and harvest restricted. The most protective category and the category most directly parallel to the protection afforded wildlife species is highly safeguarded. Species falling into the salvage restricted, salvage assessed, or harvest restricted categories pertain to the commercial salvage, removal for sale, and harvest of certain plant species that are vulnerable to theft, vandalism, or over utilization. These four categories are defined as follows:

- **Highly Safeguarded :** Those Arizona native plants whose prospects for survival in the state are in jeopardy or are in danger of extinction throughout all or a significant portion of their ranges, or are likely to become so in the foreseeable future, including federally listed species.

- **Salvage Restricted:** Those Arizona native plants that are not included in the highly safeguarded category but are subject to damage by theft or vandalism.

- **Salvage Assessed:** Those Arizona native plants that are not included in either the highly safeguarded or salvage restricted category but have a sufficient value if salvaged to support the cost of salvage.

- **Harvest Restricted:** Those Arizona native plants that are not included in the highly safeguarded category but are subject to excessive harvesting or overcutting because of their intrinsic value.

4.7.1.3 Federally Protected Species and State Listed Species that May Occur on the BMGR

This subsection includes an overview of those species or subspecies that occur on the BMGR and are listed by the USFWS as threatened, endangered, or candidates for listing, and/or animals listed by the AGFD as Wildlife of Special Concern in Arizona, and/or plants listed by the Arizona Department of Agriculture as highly safeguarded. Table 4-19 lists these species and their corresponding federal and/or state status, potential for presence of the species or its habitat on the BMGR, and brief habitat descriptions. The data for this table, including the potential for the species or species' habitat to be present on the BMGR (categorized as present, potential, or not expected) was obtained from previous studies completed for the BMGR, principally the 1986 Natural Resources Management Plan for Luke Air Force Range (U.S. Air Force 1986), Renewal of the BMGR Land Withdrawal Legislative EIS (U.S. Air Force 1999), and YTRC Final EIS (U.S. Marine Corps 1997). The status of species is current as of the publication date of this EIS. It should be noted that status designations are subject to change over time, with new listings, delistings, or status changes being made by the appropriate agencies. For species with distinct populations that may have different protected status (e.g., the Mohave population of desert tortoise, which is listed as federally threatened), only the status that pertains in Arizona is listed. Migratory birds and native plants listed by the Arizona Department of Agriculture as salvage restricted, salvage assessed, or harvest restricted are not included in Table 4-19 because their protective status does not correlate to that of the other species included in the table; however, these protected species are discussed in this subsection.

TABLE 4-19
FEDERALLY PROTECTED SPECIES AND STATE LISTED SPECIES POTENTIALLY PRESENT ON THE BMGR

Common Name *Scientific Name*	Federal Status	State Status	Species or Habitat			Habitat on Range
			present	potential	not expected	
MAMMALS						
Sonoran pronghorn *Antilocapra americana sonoriensis*	E	WC	✓			East of Gila and Tinajas Altas mountains
Yuma puma *Felis concolor browni*	—	WC		✓		BMGR—West is within species range; no sightings
Lesser long-nosed bat *Leptonycteris curasoae yerbabuenae*	E	WC	✓			Cave or mine-nesting/ roosting summer resident, forages in desertscrub habitats
Mexican long-tongued bat *Choeronycteris mexicana*	—	WC			✓	Cave or mine-nesting/ roosting, forages on saguaro and agave

TABLE 4-19
FEDERALLY PROTECTED SPECIES AND STATE LISTED SPECIES POTENTIALLY PRESENT ON THE BMGR

Common Name *Scientific Name*	Federal Status	State Status	Species or Habitat			Habitat on Range
			present	potential	not expected	
California leaf-nosed bat *Macrotus californicus*	—	WC	✓			Cave or mine-nesting/ roosting year-round resident, forages in desertscrub or xeroriparian areas
Spotted bat *Euderma maculatum*	—	WC		✓	✓	Riparian areas, rocky cliffs
Southern yellow bat *Lasiurus ega*	—	WC		✓	✓	In association with palm trees, may occur in vicinity
BIRDS						
Cactus ferruginous pygmy-owl *Glaucidium brasilianum cactorum*	E	WC		✓		Xeroriparian areas
Yuma clapper rail *Rallus longirostris yumanensis*	E	WC			✓	Marsh habitat not found on the BMGR
Southwestern willow flycatcher *Empidonax trailii extimus*	E	WC			✓	Well-developed riparian areas with cottonwood, willow, or tamarisk are not present on the range
Bald eagle *Haliaeetus leucocephalus*	T	WC			✓	Aquatic habitat not found on the BMGR
Mountain plover *Charadrius montanus*	PT	—			✓	Rare to uncommon winter transient
Ferruginous hawk *Buteo regalis*	—	WC			✓	Uncommon winter resident or visitor
Snowy egret *Egretta thula*	—	WC			✓	May appear during seasonal migration
Peregrine falcon *Falco peregrinus anatum*	—	WC	✓			Isolated cliffs; winter migrant
Crested caracara *Caracara cheriway*	—	WC			✓	BMGR is outside its normal range
Tropical kingbird *Tyrannus melancholicus*	—	WC			✓	A short distance from its normal range, may be expected occasionally
Belted kingfisher *Ceryle alcyon*	—	WC			✓	Rare transient
Sprague's pipit *Anthus spragueii*	—	WC			✓	A short distance from its normal range, may be expected occasionally

TABLE 4-19
FEDERALLY PROTECTED SPECIES AND STATE LISTED SPECIES POTENTIALLY PRESENT ON THE BMGR

Common Name *Scientific Name*	Federal Status	State Status	Species or Habitat			Habitat on Range
			present	potential	not expected	
REPTILES AND AMPHIBIANS						
Flat-tailed horned lizard *Phrynosoma mcalli*	—	WC	✓			West of the Gila Mountains
Colorado Desert fringe-toed lizard *Uma notata rufopunctata*	—	WC	✓			Aeolian sand dunes
Desert tortoise (Sonoran population) *Gopherus agassizii*	—	WC	✓			Mountains east of San Cristobal Valley
Great Plains narrow-mouthed toad *Gastrophryne olivacea*	—	WC		✓		Moist crevices or burrows, near ephemeral water sources
PLANTS						
Peirson's milkvetch *Astragalus magdalenae peirsonii*	T	—	✓			On low, partially stabilized dues in BMGR—West
Acuña cactus *Echinomastus erectocentrus acunensis*	C	HS	✓			Only one confirmed individual observed in BMGR—East
Sand food *Pholisma sonorae*	—	HS	✓			Sand dunes in the extreme southwestern portion of the range
Crested (fan-topped) saguaro *Carnegiea gigantea*	—	HS	✓			Within saguaro populations throughout the range

C=Candidate
E=Endangered
HS=Highly Safeguarded
PT=Proposed Threatened
T=Threatened
WC=Wildlife Species of Concern in Arizona
Sources: U.S. Air Force 1986 and 1999; U.S. Marine Corps 1997, Arizona Department of Agriculture 1999, AGFD 1996 (in prep), and USFWS 2002a.

The BMGR is not currently within federally designated or proposed critical habitat for any endangered or threatened species.

Mammals

Sonoran Pronghorn

Status: The Sonoran pronghorn is federally listed as endangered (32 Federal Register 4001 dated 11 March 1967) without determination of critical habitat. This species is also listed as a Wildlife Species of Special Concern in Arizona (AGFD 1996 in preparation).

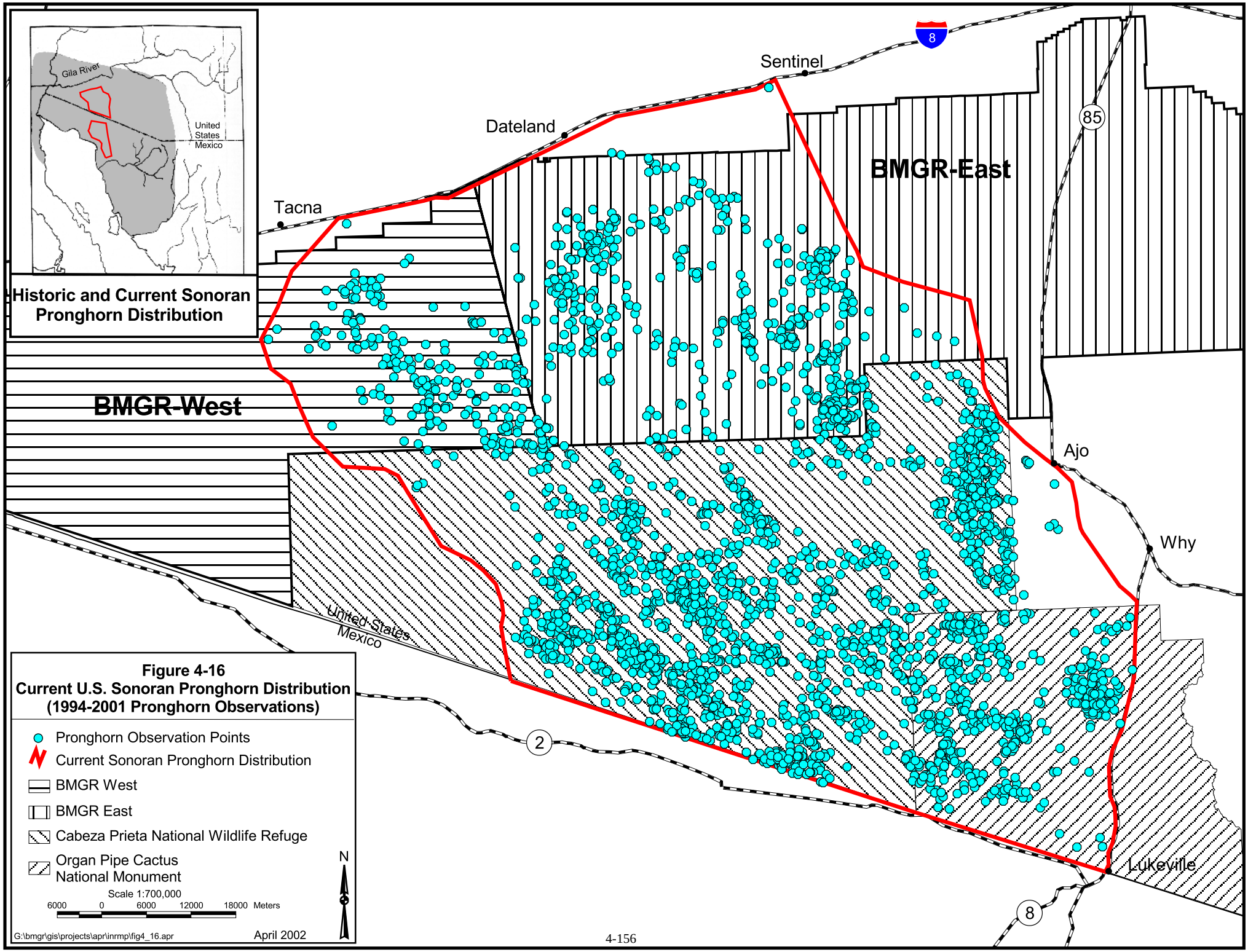
Background Information: Figure 4-16 shows the current distribution of Sonoran pronghorn. Relative to other protected species, an extensive account of background information regarding the Sonoran pronghorn is included herein due to the level of concern currently placed on the protection and recovery of this species and the commensurate management implications for the proposed INRMP addressed in this EIS.

Distribution

The factors that influence Sonoran pronghorn distribution are summarized as follows in terms of abiotic (physical and non-living chemical) and biotic (interaction with the living environment) factors:

Abiotic Factors: Typically, within the U.S. portion of the subspecies' range, Sonoran pronghorn winter in the valley floors and bajadas of the western portion of the U.S. range and move south, east, and upslope as far as the foothills in the summers (USFWS 1998a), although movements are variable depending on environmental conditions. Slopes greater than 20 percent are generally avoided (Lee and others 1998). Some extensive sandy areas within the present Arizona distribution of Sonoran pronghorn are also valuable Sonoran pronghorn habitat, most notably the Pinta Sands on Cabeza Prieta NWR and the Mohawk Valley just west of the Mohawk Mountains (Lee and others 1998). Mean elevations of the valleys that form the major portion of the Sonoran pronghorn habitat vary from 400 feet above sea level in the northwestern end of the Mohawk Valley to over 1,600 feet in the Valley of the Ajo on the east end of the current Sonoran pronghorn distribution. Sonoran pronghorn occur in one of the hottest and driest climates found in Arizona with total annual precipitation averages of 4 to 9 inches in much of the area and afternoon maximum temperatures from mid-May through mid-September in excess of 100°F (Carr 1981).

Sonoran pronghorn are known to use free-standing water but get most of their moisture from their forage. The relationship between Sonoran pronghorn and free-standing water and the use of free-standing water as a recovery tool are still under investigation. During the severe drought conditions of the summer of 2002, emergency and experimental techniques were implemented involving the hauling of water tubs to remote areas on Cabeza Prieta NWR, where pronghorn activity was tracked and fawns were observed. The animals responded to the waters and cameras were affixed to the water tubs to photograph activity in an attempt to gather information on how


Historic and Current Sonoran Pronghorn Distribution
Gila River
United States
Mexico
Sentinel
Dateland
Tacna
BMGR-East
BMGR-West
Ajo
Why
Lukeville
United States
Mexico
8
85
2
8
Figure 4-16
Current U.S. Sonoran Pronghorn Distribution
(1994-2001 Pronghorn Observations)
Pronghorn Observation Points
Current Sonoran Pronghorn Distribution
BMGR West
BMGR East
Cabeza Prieta National Wildlife Refuge
Organ Pipe Cactus
National Monument
Scale 1:700,000
6000 0 6000 12000 18000 Meters
N
G:\bmgr\gis\projects\apr\inrmp\fig4_16.apr
April 2002

to make them more effective. The water tubs may have extended the survival of the two fawns that had access to the water tubs as these fawns survived through the summer, but did not prevent their eventual death in the fall (Morgart 2002b and 2002c).

Biotic Factors: Ground cover averages for the American pronghorn on shrub-steppe areas are 50 percent living vegetation and 50 percent bare ground, rock, and litter. The amount of ground covered by vegetation in Sonoran pronghorn habitat is somewhat less (Hervert 2002). On grasslands, 60 to 80 percent of the ground cover is vegetation and 20 to 40 percent is non-vegetation (Lee and others 1998).

Sonoran pronghorn are opportunistic foragers, feeding on forbs in the spring and fall when they are available after the winter rains and summer monsoons (Wright and deVos 1986). Hervert and others (2000) collected 229 fecal pellet samples during the course of a four-year study of Sonoran pronghorn diet (1994 to 1998). The findings were that Sonoran pronghorn diet is variable among seasons and years depending on what forage species are available. Analysis of the 229 fecal pellets found that there were 132 different plant taxa that Sonoran pronghorn fed upon.

In those Sonoran pronghorn fecal pellets collected and analyzed by Hervert and others (2000), browse (shrubs and trees) and forb species were the main components of these Sonoran pronghorn's diets. Browse comprised the highest percentage of Sonoran pronghorn diet in all seasons except wet summers. Browse accounted for 53.2 percent of the dry winter diet, 46.1 percent of the dry summer diet, 43.3 percent of the wet winter diet, and 27.6 percent of the wet summer diet. White bursage, white ratany, ironwood, and mesquite were important browse species. Forbs were the main component, 42 percent, of the diet during wet summer, when forbs were both available and succulent. During the other seasons, forbs comprised about one third of the diet. Important forbs included buckwheat, goldenrod, locoweed, and species in the Borage family. This is consistent with the findings of AGFD (1981) and Hughes (1991), where forbs were reported to account for between 41 and 69 percent of the Sonoran pronghorn diet when available. Grasses were eaten in small quantities, except in wet winter when they comprised 12.7 percent of the diet. Sonoran pronghorn fed on cacti during all seasons; however, the use of cholla, particularly chain fruit cholla, increased in summer months. Amounts of total cacti species consumed ranged from 7.3 percent in wet winters to 14.2 percent in dry summers. Other studies of Sonoran pronghorn use of cacti have varied from seven percent (AGFD 1981) to 53 percent (Hughes and Smith 1990). According to Hughes (1991), cacti can account for more than 50 percent of Sonoran pronghorn diet during the summer and 22 percent during other times of the year. Seventy percent of the foraging observations made by Hughes and Smith (1990) included Sonoran pronghorn feeding on cholla fruits. Prior to Hervert and others (2000), the most common reported components of Sonoran pronghorn diet were cholla, spurge, wooly plantain, white bursage, paloverde, ratany, mistletoe, ironwood, filaree, and honey mesquite (AGFD 1981, Hughes 1991).

These findings are consistent with studies of pronghorn feeding habits in other parts of the United States. Hughes and Smith (1990) found forbs were eaten by Sonoran pronghorn in higher percentages than browse during both wet and dry seasons in 1988 and 1989. However, these years were wetter than during the years of the Hervert and others (2000) four-year study. Forbs were also reportedly consumed more than browse based on fecal analysis conducted from 1974 to 1997 by the AGFD (1981). The importance of nutritious forbs to Sonoran pronghorn, particularly at critical times of the year such as late gestation, lactation, weaning, and growth of fawns, should not be underestimated. However, when forbs are lacking, as is common in the Sonoran desert, perennial browse most likely sustains pronghorn (Hall and others 2000).

Sonoran pronghorn will travel long distances for forage. Home ranges of Sonoran pronghorn, as reported in Hervert and others (2000), are highly variable and range from 142 km^2 to 4,067 km^2, with an average home range size of 920 km^2. The home range of Sonoran pronghorn is larger than reported for other subspecies of pronghorn. Habitat quality is believed to influence home range size and the large observed home ranges may reflect the harsh environmental conditions typical of Sonoran pronghorn habitat (Hervert and others 2000). Prior to the work of Hervert and others (2000), the home range of Sonoran pronghorn was thought to be 45 km^2 for females and 56 km^2 for males (deVos 1990). The large home ranges are thought to be a function of the lower habitat quality of the Sonoran pronghorn and the need to seek out the best available forage and/or water.

Hughes (1991) found the frequency of vertical obstruction (trees and large shrubs) was greater in areas occupied by Sonoran pronghorn in the dry season than at sites frequented in the wet season. He attributes this difference to a greater need for shade during the hot dry summer. While shade may influence Sonoran pronghorn use of such areas in the dry season, it is more likely that the movement can be attributed to the fact that areas with trees and large shrubs have the best remaining forage in the dry season. Recent data show that approximately 80 percent of the variation in the use of habitat during the hot, dry months can be explained by chain fruit cholla distribution (Hervert and others 2000). Furthermore, some of the remaining variation can be explained by the presence of free-standing water.

Reasons for Decline

The Final Revised Sonoran Pronghorn Recovery Plan (USFWS 1998a) lists the following reasons for the declining population: insufficient forage and/or water, lack of recruitment, drought coupled with predation, illegal hunting, barriers to expansion within historical habitat, and habitat degradation from historical livestock grazing. These factors have been grouped for more detailed discussion as follows:

Climatic Factors: Recent work strongly indicates weather patterns as a major reason for the declining Sonoran pronghorn population. Adequate winter rainfall is necessary to grow and sustain winter annuals into the spring and early summer–a critical period for lactating females and new fawns. AGFD aerial survey studies have shown a direct correlation between winter rainfall and forage conditions and fawn recruitment (Hervert and others 2000). Hervert suggests that lower quality forage may sustain adults at this time but likely fails to meet the minimum needs of growing fawns.

Bright and others (2001a) monitored recruitment through the drought years from 1995 to 1997. These results, based on weekly aerial monitoring of radio-collared pronghorn, may not be wholly representative of the total population, but represent the best available data (the goal is to maintain collars on about ten percent of the Sonoran pronghorn population). The report estimates that few fawns were recruited in 1995 (12 fawns per 100 females) and no known recruitment occurred in 1996 or 1997. Rainfall was above the long-term average in 1998 and fawn recruitment increased to 33 fawns per 100 females. However, the spring of 1999 had below average rainfall and no fawns were known to have survived to December. The spring of 2000 was also dry and Bright and others (2001a) estimate recruitment at 14 fawns per 100 females. Climatic conditions in 2001 were favorable for fawns and there was an estimated 78 fawns per 100 females in December 2001 (Hervert 2002). Extrapolation of these data indicate that about 50 fawns were added to the population in 2001, which likely resulted in a population similar to December 1998 or about 140 animals (Morgart 2002a). Bright and others (2001a) also suggests that the advancing age of the population itself is a threat; with little recruitment over the past six years, animals that die of old age are not being replaced. Seven fawns were observed during the 2002 fawning season (Faltisco 2002b). Of these, two are thought to have survived through the summer. The emergency and experimental placement of water tubs in locations where these fawns were observed may have contributed to the survival of these fawns through the summer (Morgart 2002).

Predation: Various predatory birds (including golden eagle [Barry 2002d]) and mammals (including coyote and mountain lion) are known to prey on pronghorn. In general, predation on pronghorns is significant when predator numbers are high relative to pronghorn numbers (Yoakum and others 1996, Yoakum and O'Gara 2000). Only anecdotal information exists at this time on predator numbers relative to Sonoran pronghorn; however, any predation on a severely depressed population may be significant (Errington 1956, Scott and others 1994).

Fawns that are at three weeks of age or less are most susceptible to loss from predators (O'Gara and Yoakum 1992). Adult American pronghorn on the National Bison Range in Montana were not at risk from predation by coyotes due to their attentiveness and superior speed (Byers 1997). Conversely, coyotes were a serious predator of pronghorn fawns up to about 45 days of age (Byers 1997).

Phelps (AGFD 1981) reports that the coyote is the major predator on Sonoran pronghorn. He cites a coyote scat study from 1969 that reported less than 0.8 percent of 580 samples contained Sonoran pronghorn remains. Although this evidence suggests a low rate of predation, removal of individuals, especially fawns and adult females, from a population as small as the current Sonoran pronghorn population can be significant (Hervert and others 2000).

Although coyotes, and perhaps other predators as well, are thought to prey heavily on Sonoran pronghorn fawns, the more serious threat to the U.S. subpopulation appears to be the level of predation that occurs on adults in some years (Hervert 2002). Five of 22 adult Sonoran pronghorn captured in 1994 died within one to 33 days post-capture. Three of these mortalities were from unknown causes, while two appeared predator-related (mountain lion and coyote). Since it is unusual to have this many animals die within 40 days post-capture, the direct or indirect effects of capture myopathy was a suspected factor in their deaths (Hervert and others 2000). Of 24 remaining documented adult mortalities since 1994, 11 (46 percent) were directly attributable to predation (i.e., six coyote, two bobcat, two mountain lion, and one unknown). Some of the 12 mortalities attributed to unknown causes were likely caused by predation (Hervert 2002); however, unavoidable lags between time of death and scene investigation caused available evidence to sometimes be obscured by weather and scavengers (Hervert 2002, Morgart 2002a). In summary, this empirical evidence demonstrates that the level of predator-related adult mortality is high given the current low numbers of Sonoran pronghorn in the United States, and could pose serious problems for the eventual recovery, or for that matter continued maintenance of this subpopulation.

Human Encroachment: Human-induced impacts can be both local and regional. The impacts of historic farming and irrigation, town development, grazing, and highways on Sonoran pronghorn habitat had a regional impact. The combined effects of historical cattle grazing and the drying of riparian areas from human activities resulted in a degradation of forage quality and abundance, thus shrinking the Sonoran pronghorn's range.

Hunting of Sonoran pronghorn was prevalent until the 1920s when it was outlawed. Poaching continued but has not been considered a significant problem in the United States because the majority of the animals' range was converted to a wildlife refuge, national monument, and military range approximately in the late 1930s (Wright and deVos 1986). Poaching still occurs in Mexico, despite being outlawed there in 1922. Illegally taken animals are considered a limiting factor to the size of the population in Mexico (Wright and deVos 1986).

The majority of Sonoran pronghorn range in the United States is located within the BMGR, Organ Pipe Cactus NM, and Cabeza Prieta NWR and has, therefore, been under federal management for several decades. The Sonoran pronghorn range outside of these areas is federal land under BLM jurisdiction and referred to as the Ajo allotments. The BMGR makes up about 40 percent of the Sonoran pronghorn range within the United States and activities there could result in regional impacts. The AGFD conducted a study to assess the potential effects of military

activities on Sonoran pronghorn fawn recruitment (Hervert and others 2000). The study noted an apparent attraction of Sonoran pronghorn to military target areas and suggested that this may be the result of greater availability of forbs and water and greater visibility on the disturbed land. Comparing fawn mortality rates on the range to those at Organ Pipe Cactus NM and Cabeza Prieta NWR over four years, the study found no evidence that fawn survival was affected by military training activities. The report concludes that although human stress may adversely impact fawn survival, the level of disturbance associated with the BMGR females not appear to cause a detectable impact on fawn survival (Hervert and others 2000).

A more recent study examined the effects of noise from military overflights at the BMGR on Sonoran pronghorn (Krausman and others 2001). This study was designed to determine whether noise from overflight aircraft, practice and live ordnance delivery, and ground-based human activity affect the behavior of Sonoran pronghorn. From 1998 to 2000, 109 direct military overflights (i.e., less than 100 meters to side of animals) and 313 other overflights (i.e., greater than 100 meters to side of animals) of Sonoran pronghorn were observed. During direct overflights, pronghorn changed their behavior (e.g., from bedded to standing, walking to bedded, foraging to bedded) 45 times (41 percent of all observed overflight events) with four changes from any other activity to trotting or running (3.7 percent of all observed overflight events). During overflights that occurred more than 100 meters to the side of animals, the Sonoran pronghorn changed behavior 105 times (34 percent of all observed overflight events) with five changes to trotting or running (1.6 percent of all observed overflight events). Sonoran pronghorn females and their fawns moved 10 meters or more during two of the running events. The report notes that such a response to manmade stimuli has also been observed in bighorn sheep females with lambs and female caribou with young calves. Ground stimuli activities observed included the presence of vehicles or people in the vicinity of Sonoran pronghorn. During the study period, 2,121 ground stimuli events were recorded. Ground stimuli were associated with 866 instantaneous changes in behavior (39 percent of all ground stimuli events observed) with 56 of these events (2.6 percent of all ground stimuli events observed) involving a change to trotting or running.

Based on their data, Krausman and others (2001) found that: "(1) behavior patterns of pronghorn were similar with and without the presence of military stimuli, (2) behavior patterns of pronghorn exposed to military activities were similar to that of pronghorn not exposed to regular military activities, and (3) auditory characteristics [of pronghorn] were similar for ungulates that have and have not been exposed to sound pressure levels characteristic of military activity." Although these researchers found that military activity is associated with changes in the behavior of pronghorn, they conclude that these changes do not likely influence animals in a detrimental manner.

Disease: Research on disease is not included on the list of projects from the Final Revised Sonoran Pronghorn Recovery Plan (USFWS 1998a). Data on the disease rates in Sonoran pronghorn are scarce and the potential impacts of disease are unclear. In his study of Sonoran

pronghorn, deVos (1990) found no evidence of any of the five diseases tested for in seven animals examined. Yoakum (1980) states that American pronghorn are noteworthy for their lack of epizootic diseases.

Conversely, the Final Revised Sonoran Pronghorn Recovery Plan (USFWS 1998a) cites a University of Montana disease testing study conducted in 1994 that detected antibodies against epizootic hemorrhagic disease and bluetongue present in many American pronghorn. Bluetongue and epizootic hemorrhagic disease are similar and can only be distinguished through examination of blood samples. Both diseases are described together under the name hemorrhagic disease. The viruses of hemorrhagic disease occur in livestock throughout the United States and are transmitted by the biting midge (Jessup and Boyce 1996). In more northern pronghorn populations, individuals exposed to bluetongue rarely survive. However, Sonoran pronghorn populations demonstrate a high exposure rate to bluetongue (Heffelfinger and others 1999) with no obvious clinical signs of the disease in captured or observed pronghorn (Morgart 2001).

The Final Revised Sonoran Pronghorn Recovery Plan (USFWS 1998a) and recovery actions identified by the Recovery Team include several actions to further evaluate the role disease may be playing in the decline of Sonoran pronghorn (see Table 4-21 in Subsection 4.7.2).

Population Estimates and Population Viability

Historic estimates of the Sonoran pronghorn population, like their historic range, are problematic because the *sonorensis* subspecies of American pronghorn was not described until 1945, after the population had already suffered significant declines. Furthermore, historic population estimates vary widely in the methodology used to define the extent of their geographic range. The Final Revised Sonoran Pronghorn Recovery Plan (USFWS 1998a) includes the following population estimates from literature citations for Sonoran pronghorn in the United States:

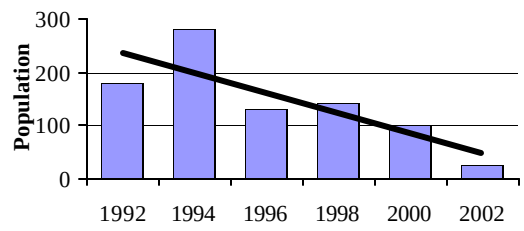
1925	Nelson estimated 105 in Arizona
1941	Nichol estimated 60 in southwestern Arizona, excluding Organ Pipe Cactus NM
1957	Holloran estimated less than 100
1968	Monson estimated 50 in Arizona
1968-1974	Carr estimated 50 to 150 based on ground observations
1981	AGFD estimated 100 to 150 in Arizona

The AGFD has made more recent estimates based on biennial aerial surveys (Bright and others 2001a), as shown in Table 4-20. These data are statistically comparable as the estimates were calculated the same way, unlike the estimates from earlier literature cited in the Final Revised Sonoran Pronghorn Recovery Plan (USFWS 1998a). Because of the availability of funds and other operational resources, the 1994 biennial survey was the only survey conducted in March

rather than in December. The preferred method is to conduct each survey during the same time of year in order to provide as much consistency as possible in terms of seasonal environmental conditions and seasonal cycles associated with Sonoran pronghorn movement patterns, activity, and fawn recruitment. The Sonoran pronghorn Recovery Team, nevertheless, regards the 1994 population estimate to be a good indicator of the Sonoran pronghorn population at that time and a reliable indicator for use in pronghorn population trend analyses. In 2001, the Sonoran Pronghorn Recovery Team did not conduct a survey, but based on aerial reconnaissance survey monitoring fawn recruitment and the best available information on mortalities and the age composition of the population, the population that year was estimated to be 138 (increasing from the estimate of 99 in 2000). Based on the December 2002 survey, which occurred from 30 November to 4 December 2002, the population estimate declined to 21, its lowest level ever (Morgart 2002b and 2002c).

TABLE 4-20
ESTIMATED SONORAN PRONGHORN POPULATION FOR 1992 – 2002

Date	Animals Observed	Population Estimate	Confidence Interval
12/1992	121	179	147 – 234
3/1994	109	282	205 – 489
12/1996	95	130	114 – 154
12/1998	98	142	125 – 167
12/2000	69	99	69 – 392
12/2002	18	21	18 – 33



Source: USFWS 2002b, Morgart 2002c

The population estimates for 1992 to 2002 (shown in Table 4-20) are largely based on range-wide, standardized, aerial surveys. Some Sonoran pronghorn have been equipped with radio collars, which facilitate the development of visibility correctional factors (Morgart 2002c). The goal is to maintain active radio collars on about ten percent of the Sonoran pronghorn population (USFWS 1998a); however, from January 2002 to October 2002, the number of animals with active radio collars was reduced from seven to one. Recollaring will not be attempted again until the animals are in a healthy condition (Morgart 2002b). Bright and others (2001a) points out that the low sample sizes inherent in all Sonoran pronghorn surveys make it likely that statistical significance could only be attributed to extreme changes in population. However, the report (which did not include the population survey/estimate data for 2001 and 2002) concludes that the survey data reflect a declining population trend.

A population viability analysis workshop was held in 1996 to model the U.S. Sonoran pronghorn population and to discuss strategies to promote its long-term survival (Defenders of Wildlife 1998). The population simulation efforts suggested that the population is at serious risk of extinction within the next 100 years. This risk was a result of the population fluctuations, poor fawn recruitment during droughts, small present population, limited habitat that prevents

expansion to a more secure population size, and expected future inbreeding effects. The model further indicated that although actions that decrease mortality for adults and juveniles would result in the greatest benefit for the population, improving any one of the most significant variables is not enough to fully protect the population from extinction.

The study went on to note that the carrying capacity of the current Sonoran pronghorn range in the United States is probably not more than 300 and that the model indicates a population of 500 is required to ensure population stability and adequate genetic diversity (Defenders of Wildlife 1998).

Populations in Study Area: The U.S. Marine Corps (2001) estimates that 13.5 and 28.1 percent of suitable terrain within the current distribution of Sonoran pronghorn is within BMGR—West and BMGR—East, respectively.

Yuma Puma

Status: The AGFD Wildlife of Special Concern in Arizona (1996 in preparation) lists the Yuma puma. It has not been taxonomically substantiated as a subspecies.

Background Information: The taxonomic validity of this subspecies is currently unresolved (Hoffmeister 1986, Johnson 1990). However, in a study using genetic analysis to aid in taxonomic assessment, McIvor and others (1995) conclude that subspecific status is probably not warranted.

Historically, this subspecies is thought to have ranged through the lower Colorado River Valley from south of Lake Mead to northwest Sonora and northeast Baja California in Mexico. In Arizona, its range may extend as far east as Gila Bend, Ajo, and Lukeville (Hall 1981; Harvey and Stanley Associates, Inc. 1987; Johnson 1990). The majority of studies tie the location of the Yuma puma to the Colorado River and adjacent areas (Cahill 1971; Williams and Kilburn 1984; Harvey and Stanley Associates, Inc. 1987; Peirce and Cashman 1993); however, there is no consensus in the literature with regard to this subspecies range (McIvor and others 1995).

Information on this subspecies' basic biology, including reproduction, territory size, and prey species is not well known (McIvor and others 1995). Home range size for pumas in desert habitats appears to be larger than for those living in more mesic environments (McIvor and others 1995). Peirce and Cashman (1993) reported the home range for one male puma as over 600 square miles. Historically, desert mule deer were probably the most important prey species for Yuma pumas (Harvey and Stanley Associates 1987), with desert bighorn sheep, Sonoran pronghorn, and small mammals being less important. Now they are likely to be more dependent on smaller prey (Johnson 1990).

The primary reasons for a possible decline in numbers of the Yuma puma have been attributed to habitat destruction, reduction of prey base, and conflicts with humans, including historic predator

reduction programs. Reduced deer populations, especially along the Colorado River, are thought to have had a significant impact (Johnson 1990).

Populations in Study Area: Based on the subspecies' range defined by Harvey and Stanley Associates (1987), and selected by McIvor and others (1995) in their review, this subspecies could potentially occur anywhere within the BMGR, although there have been no confirmed BMGR sightings reported (Harvey and Stanley Associates 1987; McIvor and others 1995). Harvey and Stanley Associates (1987) report one sighting at the southern end of the Kofa NWR and 10 within the Cabeza Prieta NWR. A map depicting Yuma puma sightings in McIvor and others (1995) shows six confirmed sightings on the Cabeza Prieta NWR. One unconfirmed sighting was recently reported in Ryan's Canyon on BMGR—West (Barry 2002d).

Lesser Long-nosed Bat

Status: Formerly known as Sanborn's long-nosed bat (*Leptonycteris sanborni*), the lesser long-nosed bat is federally listed as endangered, without determination of critical habitat (53 Federal Register 38456 dated 30 September 1988). This species is also listed in Wildlife of Special Concern in Arizona (AGFD 1996 in preparation), although it is referred to therein as Sanborn's long-nosed bat.

Background Information: Lesser long-nosed bats are medium-sized bats with a distinctively elongated nose with a leaf-shaped tip. Their known range extends from extreme southwestern New Mexico and southeastern Arizona north to the Phoenix area, west to the Agua Dulce Mountains in the Cabeza Prieta NWR, south through western Mexico (Cockrum and Petryszyn 1991), and possibly to El Salvador (Spicer 1988). In Arizona, they are summer residents within desert grasslands and scrubland up to the edge of oak woodland (Hoffmeister 1986; Hayward and Cockrum 1971). They begin migration into Arizona in early April. When they arrive, the females are pregnant and congregate in maternity colonies. Males occupy separate roosts, but such bachelor colonies are less well documented than maternity colonies (Hoffmeister 1986). The young are born between early May and late June (Hoffmeister 1986). They migrate south in the fall, leaving Arizona by early October (Hayward and Cockrum 1971).

In Arizona, lesser long-nosed bats are nectar, fruit, and pollen feeders, foraging at night in areas of saguaro, agave, ocotillo, paloverde, prickly pear, and organ pipe cactus. While feeding, they either land on the plant or hover like a hummingbird (Hoffmeister 1986; Hayward and Cockrum 1971). They are found in areas of dense columnar cacti in the spring and at higher elevations in areas of high agave density in oak-piñon forests in the summer and fall (Hall and others 2001). Lesser long-nosed bats fly long distances (up to 75 miles) between roosting and feeding areas (USFWS 1994). During the day, they roost in mine tunnels and natural caves where they can find total darkness and a specific temperature range (Hayward and Cockrum 1971, Hall and others 2001).

Threats to lesser long-nosed bats have been identified as the destruction or disturbance of roosting sites and possibly loss of agave populations (Spicer 1988). Cockrum and Petryszyn (1991) conclude that population levels in the northwestern part of the species range have not decreased significantly, if at all, during the past 25 years; numbers may have actually increased over the past 100 years due to the increase in availability of mine sites for roosting.

Populations in Study Area: No lesser long-nosed bat roosts have been documented on the BMGR despite a number of bat surveys (Dames & Moore 1997a, Dalton and Dalton 1994, Cockrum and Petryszyn 1991). Densities of agaves and columnar cacti are too low to provide an important food source for the bats throughout most of the range (U.S. Air Force 1997). If lesser long-nosed bats occur on the BMGR, they are not abundant. The eastern areas of the BMGR, particularly in the Sand Tank Mountains, however, represent good habitat for foraging or roosting (Hall and others 2001). Dalton and Dalton (1999) consider the presence of lesser long-nosed bat in this part of the BMGR to be likely.

There is a maternity colony of 5,000 female lesser long-nosed bats in Bluebird Mine in the Growler Mountains in the Cabeza Prieta NWR. A large colony (16,000 to 19,000 females) is present in the vicinity of Montezuma's Head in the Ajo Range in Organ Pipe Cactus NM (Hall and others 2001). The bats are also known from the Agua Dulce Mountains in the southeast corner of the Cabeza Prieta NWR (Cockrum and Petryszyn 1991). A total of six light-tagged lesser long-nosed bats were observed in the former Area A portion of the BMGR in late May and early June of 1994 (Dalton and Dalton 1994).

Mexican long-tongued bat

Status: The Mexican long-tongued bat is identified as a Wildlife of Special Concern in Arizona (AGFD 1996 in preparation).

Background Information: This bat is known to roost in small groups, usually in caves, but also often in relatively exposed locations. Biology and population status is poorly known, but a decline in numbers is evident. Threats are also not well known, but human disturbance of roost sites seems likely to be an important factor. Agave harvests in Mexico may also be negatively affecting this species, since it is thought to feed heavily on the nectar and pollen of agave flowers. It also relies on the nectar and pollen of saguaro flowers (AGFD 1996).

Populations in Study Area: The Mexican long-tongued bat is a summer resident of southeastern Arizona and may also occur in extreme western Arizona (AGFD 1996). No evidence of Mexican long-tongued bats was found in a thorough survey of inactive mines conducted by Dalton and Dalton (1994).

California Leaf-nosed Bat

Status: The California leaf-nosed bat is listed in the AGFD's list of Wildlife of Special Concern in Arizona (1996 in preparation).

Background Information: The California leaf-nosed bat is a year-round resident in desertscrub habitats (mostly Sonoran desertscrub) of southern and western Arizona south of the Mogollon Rim (Hoffmeister 1986). It is locally common, roosting colonially in mines, caves, and under bridges (AGFD 1988; Cockrum 1964). California leaf-nosed bats remain active throughout the year in Sonoran desertscrub habitats due to the relatively mild climate and continuous availability of food. Warm, geothermally active mines are particularly important for these cold-intolerant bats. Xeroriparian corridors and larger tinajas are important foraging areas, as well as high-density saguaro areas because they attract many insects (Hall and others 2001). They feed primarily on large night-flying beetles, grasshoppers, and moths. They also feed on insect larvae, especially of butterflies, which are taken from bushes or on the ground. There is some evidence that they also feed on fruits, including those from cacti. Their home range and local seasonal movements are largely unknown (Hoffmeister 1986). Their numbers are thought to be low, apparently due to limited winter roosts and vandalism at roost sites (AGFD 1988).

Populations in Study Area: This species has been located throughout the entire BMGR and is purported to be the most common bat on the BMGR (Hall and others 2001). Roosting locations have been surveyed in the Sand Tank and Sauceda mountains (Dalton and Dalton 1999, Dalton and others 2000, Dalton 2001). Active roosts have been documented at 11 sites throughout the BMGR in the Sand Tank and Sauceda mountains (Noonan Group), Mohawk Mountains (Red Cross Mine), Copper Mountains (Old Soak, Betty Lee Mine, and Buck Peak), Wellton Hills (Wellton Hills Mine and Poorman), and Gila Mountains (Fortuna Mines). Some mines have been estimated to support as many as 300 individuals (Dalton and Dalton 1994; Dames & Moore 1996 and 1997a). Foraging patterns of the Sand Tank Mountains population have been recently studied in detail. Findings indicate that foraging behavior varies with season with bats foraging for one 0.5- to 4.5-hour bout during the first part of the night in winter and several foraging bouts interspersed with roosting periods of about equal time, spanning the entire night in summer. During the course of two consecutive studies, bats were found to move between a maximum of seven day and a minimum of four night roost sites. Foraging area for individual bats ranged from 0.73 to 47.3 square kilometers and ranged from valley floors to slopes and ridges, with a tendency towards valleys in the summer and slopes and ridges in winter. Total foraging area was estimated to range from 14.9 to 27.2 square kilometers (Dalton and others 2000, Dalton 2001)

Spotted Bat

Status: The spotted bat is identified in the AGFD's list of Wildlife of Special Concern in Arizona (1996 in preparation).

Background Information: Very little is known about the habitat distribution and basic biology of this species. The spotted bat is known from central Canada to the western and southwestern United States, and into northeastern Mexico (Hill and Smith 1984). It has been recorded in only a few locations in Arizona near Yuma and Phoenix, and the northwestern border with Utah (Spicer 1991). It is unclear what the preferred habitat of this species is, though several researchers feel it consists of uneven rocky cliffs within a mile or so of a riparian habitat. Others suggest that the bat is a resident of ponderosa pine forests in June and July, and wanders into lower elevation habitats in the late summer and fall (Hoffmeister 1986). Like other members of its family, the spotted bat is probably wholly insectivorous, catching insects while in flight or picking them from leaves and other vegetation (Hill and Smith 1984). Factors limiting the distribution and abundance of this species may be suitable roost sites or availability of prey items (Spicer 1991).

Populations in Study Area: In southwest Arizona, the spotted bat has been found in low deserts (AGFD 1988; Spicer 1991). There is a known locality near the Gila River, nine miles east of the town of Roll (Hoffmeister 1986), which is north of Interstate 8 and BMGR (near Tacna). No evidence of spotted bats was found in a thorough survey of inactive mines conducted by Dalton and Dalton (1994).

Southern Yellow Bat

Status: The southern yellow bat is included in the AGFD's list of Wildlife of Special Concern in Arizona (1996 in preparation).

Background Information: This bat ranges from South America northward to the southwestern United States. It is thought to occur year round in parts of southern Arizona near palm oases and riparian habitats. This species is primarily associated with palm trees, apparently preferring the native California fan palm. Little is known about its habitat needs and population dynamics. Possible threats include loss of native palms from vandalism (e.g., burning) and pruning of urban palms (AGFD 1996).

Populations in Study Area: This species is presumed to be a year-round resident in scattered areas across southern Arizona (AGFD 1996). No evidence of southern yellow bats was found in a thorough survey of inactive mines conducted by Dalton and Dalton (1994).

Birds

Cactus Ferruginous Pygmy-owl

Status: The cactus ferruginous pygmy-owl is federally listed as endangered in Arizona (62 Federal Register 10730 dated 10 March 1997). Critical habitat was designated for this species, an area encompassing 731,712 acres of riverine riparian and upland habitat in Pima, Cochise, Pinal, and Maricopa counties (64 Federal Register 37419-374400 dated 12 July 1999). However, this critical habitat designation was vacated and remanded to the USFWS for further proceedings by the U.S. District Court for the District of Arizona on 19 September 2001 (Order in Case No. CIV-00-0903-PHX-SRB, National Association of Home Builders, et al. versus Gale A. Norton et al. and Defenders of Wildlife, et al.). The court found that the USFWS failed to adequately study possible economic impacts when it designated critical habitat for the cactus ferruginous pygmy owl in 1999. The cactus ferruginous pygmy-owl is also listed in Wildlife of Special Concern in Arizona (AGFD 1996 in preparation).

Background Information: The cactus ferruginous pygmy-owl is most active early in the morning and late in the day. It preys on lizards, insects, rodents, and birds. The owl nests in cavities in trees and columnar cacti. The range of the cactus ferruginous pygmy-owl includes the southern half of Arizona and Texas, south to Colima and Michoacan in western Mexico and Tamaulipas and Nuevo Leon in eastern Mexico. In Arizona, resident populations of the cactus ferruginous pygmy-owl are found in xeric riparian washes of Organ Pipe Cactus NM, Altar Valley, and northwest Tucson. The owl used to be more widespread, occurring throughout southern Arizona. The habitat preferences of this species are not well known, but most cactus ferruginous pygmy owls in Arizona are observed within Organ Pipe Cactus NM in washes containing microphyll woodlands. Their territories have been described as linear (washes), and between approximately 1.3 to 2.5 acres (Millsap and Johnson 1988). However, recently owls have also been observed in saguaro-ironwood forests.

Populations appear to have declined substantially since 1950 (AGFD 1996). Declines in Arizona have been attributed to loss of riparian forests and woodlands (AGFD 1988; Millsap and Johnson 1988), urban development, and competition with European starlings for nesting cavities (AGFD 1996).

Populations in Study Area: Based on the known distribution of this species in southwest Arizona, it is expected to occur on the BMGR. However, no pygmy owls have been detected on the range since the first surveys in 1992 (Barry 1999, 2000, 2001a). Many of the early surveys were one-time efforts and current methods require at least three separate surveys due to this species' varied response rates. In recent years, cactus ferruginous pygmy-owls have been detected in areas near the eastern BMGR boundary.. Habitat characteristics for the species are present in xeroriparian areas of the range. There is one historical observation of the owl near the BMGR at the Cabeza

Prieta Tanks on the Cabeza Prieta NWR (Millsap and Johnson 1988) and another confirmed documentation on the refuge at Papago Well in 2001.

Yuma Clapper Rail

Status: The Yuma clapper rail is federally listed as endangered (32 Federal Register 4001 dated 11 March 1967; 48 Federal Register 34182 dated 27 July 1983) without determination of critical habitat. In addition, it is included in the Gaff's Wildlife of Special Concern in Arizona (1996 in preparation).

Background Information: The Yuma clapper rail occurs in Arizona along the Colorado River in marsh habitat that has formed behind dams, and occasionally occurs in the Salt River marshes north of Phoenix and at Picacho Reservoir (Demaree and others 1972). Along the lower Colorado River, it is a common summer resident and breeds as far north as Topock Marsh on the Havasu NWR (Rosenberg and others 1991, AGFD 1996). It was thought that this population wintered in Mexico, but studies now indicate that 70 percent of the breeding population remains on the lower Colorado (Rosenberg and others 1991). The primary reasons for the Yuma clapper rail's decline are habitat destruction due to stream channelization and drying and flooding of marshes (AGFD 1996).

Populations in Study Area: The marsh habitat required by this species is not present on the BMGR.

Southwestern Willow Flycatcher

Status: The southwestern willow flycatcher is federally listed as endangered (60 Federal Register 10694 dated 27 February 1995) with critical habitat (62 Federal Register 39129 dated 22 July 1997). It is also listed in Wildlife of Special Concern in Arizona by the AGFD (1996 in preparation).

Background Information: The southwestern willow flycatcher breeds locally in Arizona, southeastern California, New Mexico, western Texas, and southern Utah (Unitt 1987; Browning 1993). Throughout its breeding range, this species is associated with dense riparian associations of willow cottonwood, buttonbush, and other deciduous trees and shrubs. The major threat to the flycatcher is destruction and modification of habitat. Brood parasitism by brown-headed cowbirds is also a concern (USFWS 1995b). Browning (1993) notes that it breeds in swamps and willow thickets, usually along streams.

Populations in Study Area: The BMGR does not contain any dense riparian associations of willows, cottonwoods, or other deciduous trees that provide habitat for breeding southwestern willow flycatchers. Flycatchers may occur on the range incidentally during migration.

Bald Eagle

Status: The bald eagle is federally listed as threatened (60 Federal Register 6000 dated 12 July 1995) without determination of critical habitat, but it was proposed for delisting on 6 July 1999 (64 Federal Register 36453). This species is listed in Wildlife of Special Concern in Arizona (AGFD 1996 in preparation).

Background Information: In Arizona, bald eagles nest primarily on the Salt and Verde rivers in the central part of the state where large trees or cliffs provide nest sites near fish inhabited waters. In western Arizona, they nest on the Bill Williams River near Alamo Lake (Busch 1988; AGFD 1996). The number of known nest sites has increased in recent years, but it is unclear whether this represents an expanding breeding population or more concentrated search efforts for this species (AGFD 1996). Concentrations of wintering bald eagles occur primarily near aquatic habitats on the Mogollon Rim and White Mountains of central and eastern Arizona (Busch 1988). Most of the state's major river systems, including the main stem of the Colorado, support wintering bald eagles (Busch 1988; Rosenberg and others 1991). On the main stem of the Colorado this species is most commonly observed on the three national wildlife refuges, which provide protected aquatic habitats (Rosenberg and others 1991). Important food items in the Southwest include fish, waterfowl, rabbits, and carrion. Food availability and perch sites may limit wintering bald eagle abundance in Arizona. Other factors potentially limiting abundance include human disturbances and loss of aquatic habitat (Busch 1988; AGFD 1996).

Populations in Study Area: No nesting bald eagles occur on the BMGR. The entire state is considered within the range of wintering bald eagles (Busch 1988); however, important habitat characteristics (i.e., aquatic habitats in conjunction with perch sites) are not present on the BMGR.

Mountain Plover

Status: The mountain plover was federally listed as potentially threatened on 16 February 1999 (64 Federal Register 7587-7601). This species is not currently listed by the AGFD in Wildlife of Special Concern in Arizona (1996 in preparation).

Background Information: The mountain plover nests on high plains and plateaus, currently in parts of Montana, Wyoming, Oklahoma, and New Mexico, with the majority of breeding in northeastern Colorado. It is mostly rare in Arizona where it occurs in the fall in small numbers in

the western part of the state; wintering flocks are also encountered on barren desert flats and fallow fields in the Florence, Phoenix, Yuma, and Kingman areas (Monson and Phillips 1981; Demaree and others 1972). Habitat consists of dry shortgrass prairie of low, scattered bunchgrass, and sandy areas with scattered sagebrush (Terres 1980).

Populations in Study Area: Mountain plovers may occur at the BMGR as rare to uncommon winter visitors or transients. The species has been encountered in the Sierra Pinacate of northern Mexico, about 20 miles south of the Arizona border (Monson and Phillips 1981). It is unlikely that the species occurs with regularity on the BMGR.

Ferruginous Hawk

Status: The ferruginous hawk is included in the AGFD's list of Wildlife Species of Special Concern (1996 in preparation).

Background Information: The breeding range of the ferruginous hawk extends from eastern Washington, southern Alberta, southern Saskatchewan south to eastern Oregon, Nevada, northern and southeastern Arizona, northern New Mexico, north-central Texas, western Oklahoma, and western Texas. They winter in the southwestern United States from California to Oklahoma and Texas, and in Mexico (American Ornithologists Union 1983). In Arizona, it breeds sparsely in grasslands in northern and west-central portions of the state. Threats include prairie dog control programs and human disturbance near nests (AGFD 1996).

Populations in Study Area: The preferred winter habitat of this species, agricultural areas and grasslands, is not present on the BMGR. They may occur as uncommon winter residents or visitors.

Snowy Egret

Status: The snowy egret is included in the AGFD's list of Wildlife Species of Special Concern (1996 in preparation).

Background Information: Snowy egrets are marshland birds that are encountered less frequently than Arizona's other common diurnal herons. Snowy egrets are year-round residents of coastal marshlands in the southeastern United States (from the mid-Atlantic states through Texas) and California, south to South America. In Arizona, they occur year-round along the lower Gila River from Phoenix to the Colorado River and near Yuma. In summer, they breed inland through the southern states, locally as far west as California. Arizona breeding colonies exist near Yuma and below Painted Rock Dam. As with most herons, post-breeding snowy egrets widely disperse

(Johnson 2001). Nesting sites are threatened by channelization, drying of marshes, and some recreational activities (AGFD 1996).

Populations in Study Area: Snowy egrets are thought to occur on the BMGR as rare transients during seasonal migration.

Peregrine Falcon

Status: This species is listed in the AGFD's list of Wildlife of Special Concern in Arizona (1996 in preparation). The peregrine falcon was formerly federally listed as endangered without determination of critical habitat, but was delisted on 25 August 1999 (64 Federal Register 46541).

Background Information: The peregrine falcon is found across North America from northern Alaska and Canada south to southern Baja California, the coast of Sonora, and into Central and South America (American Ornithologists Union 1983). Peregrines occur on isolated cliff ledges throughout Arizona, but in small numbers (Monson and Phillips 1981). Rosenberg and others (1991) describe the species as an uncommon transient and winter visitor along the lower Colorado River from September to late March, and a rare but consistent visitor from May through August. Nest sites in Arizona are located in extensive mountain ranges or canyon systems usually near water where prey is abundant (Ellis 1982). Their principal prey includes passerine birds, waterfowl, and shore birds (Snow 1972). Falcons may travel up to 17 miles to hunting areas that often include cropland, meadows, river bottoms, marshes, and lakes, which attract abundant bird life. Falcons are usually on the nesting cliff by mid-March (USFWS 1987).

The primary reason for the decline of this species is reproductive failure due to pesticide contamination. Nationwide population declines in the 1950s and 1960s were reversed in recent years), prompting the federal delisting. The federal determination for delisting this species was based on data indicating that the population has recovered following restrictions on pesticides in the United States and Canada, and following the implementation of successful management activities (USFWS 1999a).

Populations in Study Area: Peregrine falcons occasionally winter along the lower Colorado River (Monson and Phillips 1980), but generally do not breed or winter in southwestern Arizona. They are seen on the BMGR during the winter and during migration (U.S. DOI, BLM 1990b). At least two late winter/early spring observations of peregrine falcons have been reported in the vicinity of the Aguila Mountains during recent years, which may indicate breeding on the BMGR (Barry 2002d).

Crested Caracara

Status: The crested caracara is listed in the AGFD's list of Wildlife Species of Special Concern (1996 in preparation).

Background Information: Crested caracaras reach the northern limits of their distribution in the southern United States. Populations occur in southeastern Texas, southwestern Arizona, and south-central Florida. Throughout its range, it prefers open or semi-open country. In southwestern Arizona, it is found in arid country at low elevations, roosting in tall trees or saguaros. Fewer than ten nesting pairs have been identified in Arizona, all on the Tohono O'odham Nation. Threats include human disturbances of nests (AGFD 1996).

Populations in Study Area: The BMGR is outside the normal known range of this species in Arizona, but the crested caracara may occur on the BMGR under unusual circumstances.

Tropical Kingbird

Status: The tropical kingbird is listed in the AGFD's list of Wildlife Species of Special Concern (1996 in preparation).

Background Information: This bird breeds mainly in the Santa Cruz and San Pedro River drainages in south-central Arizona. The riparian habitat is threatened by woodcutting and agricultural and urban development (AGFD 1996).

Populations in Study Area: The normal range of this bird is relatively close to the eastern extent of BMGR. This species may be expected to occur occasionally on the BMGR.

Belted Kingfisher

Status: The belted kingfisher is listed in the AGFD's list of Wildlife Species of Special Concern (1996 in preparation).

Background Information: Nests vary locally, but the belted kingfisher seems likely to be more widespread than is now known. It is restricted to habitats with permanent, fish inhabited waters, primarily the Verde River drainage in central Arizona, possibly the Black River in eastern Arizona, and the Grand Canyon segment of the Colorado River. Probable threats include diversion of stream flows and general loss of riparian habitat (AGFD 1996).

Populations in Study Area: Habitat requirements for this species are not present on the BMGR, it may occur as a rare transient.

Sprague's Pipit

Status: Sprague's pipit is listed in the AGFD's list of Wildlife Species of Special Concern (1996 in preparation).

Background Information: This species winters mainly in the Sonoita and San Rafael grasslands in eastern Arizona. It is threatened by heavy grazing of tall grasses and agricultural and urban development (AGFD 1996).

Populations in Study Area: Habitat for Sprague's pipit is not present on the BMGR. Because the normal range of this species is a short distance east of the BMGR, however, it may occasionally occur on the BMGR.

Migratory Birds

A list of migratory birds protected by the MBTA can be found at 50 CFR 10.13. When compared against the list of birds that may occur on the BMGR (Appendix D, Tables D-4 and D-5), the only birds on the BMGR that are not protected by the MBTA are three introduced species (the house sparrow, rock dove, and European starling) and Gambel's quail. The USFWS Division of Migratory Bird Management has developed a listing of migratory species of concern because of (1) documented or apparent population declines, (2) small or restricted populations, or (3) dependence on restricted or vulnerable habitats. For USFWS Region 2, the following species that may occur on the BMGR are included on that list: Northern harrier, ferruginous hawk, peregrine falcon, black tern, burrowing owl, Costa's hummingbird, gray flycatcher, vermillion flycatcher, Bendire's thrasher, curve-billed thrasher, loggerhead shrike, Bell's vireo, gray vireo, Virginia's warbler, Lucy's warbler, Cassin's sparrow, lark sparrow, black-throated sparrow, sage sparrow, and grasshopper sparrow (USFWS 1995a).

The Northern harrier and ferruginous hawk are winter residents of the agricultural lands located outside the BMGR. Harriers are known to hunt over the range. Peregrine falcon is a possible breeding species. Burrowing owl, Costa's hummingbird, vermillion flycatcher, Bendire's thrasher, curve-billed thrasher, loggerhead shrike, Bell's vireo, Lucy's warbler, and black-throated sparrow are all confirmed breeding birds on the BMGR. The remainder are migrants that only pass through the range area (Barry 2002d).

One effort to reverse the downward trends of declining migratory bird species is the voluntary, international Partners in Flight coalition. The Arizona Working Group of Partners in Flight developed the Arizona Partners in Flight Bird Conservation Plan (Latta and others 1999) as part of the national Partners in Flight effort. This plan identifies priority species and habitats and

establishes objectives for bird populations and habitats in Arizona. Of the more than 280 breeding bird species in Arizona, 43 priority species in 13 major habitats are addressed. For Sonoran desertscrub habitats (the major habitat applicable to the BMGR), one priority species is identified: the federally endangered cactus ferruginous pygmy-owl. In addition, the following five species of migratory birds are recognized as indicators of Sonoran desertscrub habitat health: Costa's hummingbird, gilded flicker, rufous-winged sparrow, Le Conte's thrasher, and purple martin (Latta and others 1999).

Reptiles

Flat-tailed Horned Lizard

Status: The flat-tailed horned lizard had been proposed for federal listing as threatened, but was withdrawn on 15 July 1996 because some threats were considered less serious than originally thought, a further reduction of threats was expected as a result of a conservation agreement, and data indicating population declines were inconclusive (USFWS 1997a). On 15 July 1997, the USFWS issued a final decision to withdraw the proposed rule to list the flat-tailed horned lizard as a threatened species (62 Federal Register 37852). Six months later, Defenders of Wildlife filed a lawsuit challenging this decision. Subsequently, the withdrawal from proposed listing was remanded to the USFWS for further consideration in a 31 July 2001 decision by the Ninth Circuit Court of Appeals. On 24 October 2001, the District Court ordered the USFWS to reinstate the previously proposed listing rule. As a result, in December 2001 the USFWS announced the reinstatement of the 1993 proposed listing for the flat-tailed horned lizard as a threatened species and the reopening of the public comment period on the proposed listing (66 Federal Register 66384) (USFWS 2001f). In September 2002, the comment period was extended for 15 days to allow for peer review, additional public comment on the proposed rule, and submittal of information that became available since the 1997 withdrawal (67 Federal Register 59809). (USFWS 2002c). On 3 January 2002, the USFWS announced the determination that the action of listing the flat-tailed horned lizard as threatened is not warranted, and consequently withdrew the proposed rule. The USFWS made this determination because threats to the species as identified in the proposed rule are not as significant as earlier believed and current available data do not indicate that the threats to the species and its habitat are likely to endanger the species in the foreseeable future throughout all or a significant portion of its range (68 Federal Register 331) (USFWS 2003). This species is listed in the AGFD's list of Wildlife of Special Concern in Arizona (1996 in preparation).

Background Information: Like other horned lizards, this species has sharp spines around the back of its head that resemble horns. Flat-tailed horned lizards are distinctly flattened and oval shaped. They range from extreme southeastern California east to extreme southwestern Arizona, and south to adjacent Sonora and Baja California, Mexico (Rorabaugh and others 1987; Turner and Medica 1982). In Arizona, they are known only from west of the Gila and Tinajas Altas

mountains and south of the Gila River below 1,000 feet (Johnson and Spicer 1985). Records from elsewhere in Arizona have been determined to be erroneous (Johnson 1989).

Flat-tailed horned lizards are typically found at the edges of dunes in open areas of fine wind blown sand (Johnson 1989; Rorabaugh and others 1987), but are mostly absent from the main body of dunes (Rorabaugh and others 1987). In Arizona, Rorabaugh and others (1987) found lizard abundance was correlated with the presence of big galleta grass, but attributed this to the presence of the sandy substrate and not the grass. The lizard's diet consists almost entirely of ants, especially harvester ants (Turner and Medica 1982).

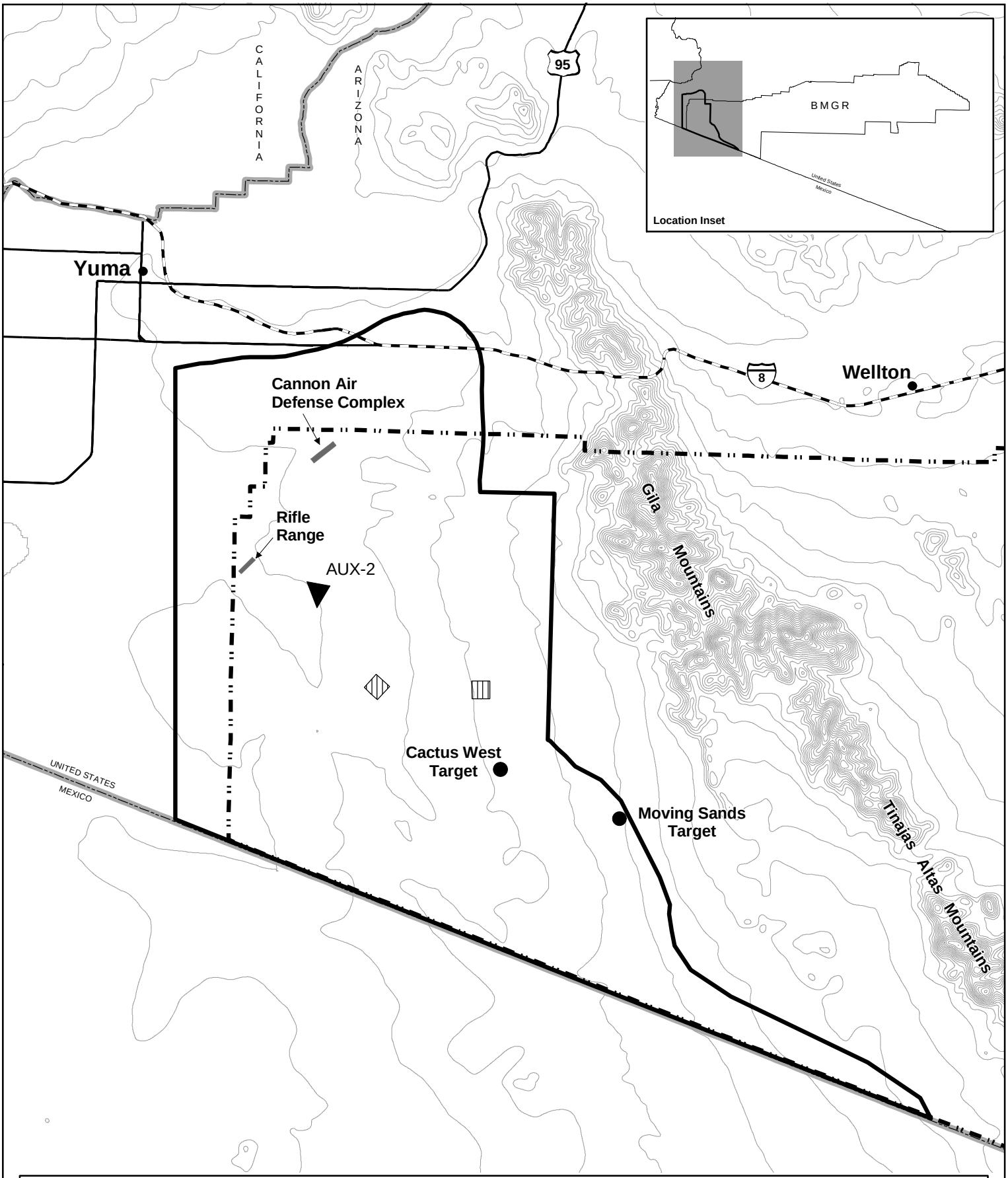
Flat-tailed horned lizards mate during April to May, lay eggs in May to July, and the eggs hatch in July to September (Johnson 1989; Howard 1974). The species is diurnal and is especially active in the morning (Mayhew and Wright 1971; Vitt and Ohmart 1978). When ambient surface temperatures pass 105ºF, the lizards maintain their body temperature by seeking refuge in a burrow or burying themselves in the sand. They are stationary predators, typically foraging next to ant colonies (Johnson and Spicer 1985).

Threats to this species' habitat are discussed in Johnson and Spicer (1985) and include agricultural development, urbanization, road construction, ORV use, and military activity. Johnson and Spicer (1985) suggest that military activities are less detrimental because military activity restricts other human activity in habitat west of the Tinajas Altas and Gila mountains to the edge of Yuma. This restriction of human activity is believed to be the most effective habitat protection available to the species in Arizona (Johnson and Spicer 1985).

Another potential threat to the flat-tailed horned lizards is pesticide use in agricultural areas, which are often located adjacent to their habitat. Pesticide use could affect the lizards directly, or indirectly through reduction of harvester ant (prey base) populations (U.S. DOI, BLM 1990b). Pesticide tolerances of flat-tailed horned lizard are not currently known (Johnson 1989). They have a definite predilection for thermoregulation on paved roads leading to and from various training areas on the BMGR and, like many other reptiles, are susceptible to road-kill (Johnson 1989).

The BMGR is considered by some experts to be the most protected portion of the range of this species and the most important part of this species' range in the United States. Currently, populations in Mexico are considered relatively secure, but they are not formally protected (Hall and others 2001).

Populations in Study Area: Flat-tailed horned lizards occur west of the Gila Mountains and Butler Hills in the extreme western portion of the BMGR, as depicted in Figure 4-17 (Johnson and Spicer 1985; Rorabaugh and others 1987). On the west side of the Gila Mountains, flat-tailed horned lizards and desert horned lizards are sympatric in many locations, but not throughout this area. To the east, the desert horned lizard and regal horned lizard can be found. The desert



N

0 1 2 3 4 5

Scale in Miles

Legend

- Flat-tailed Horned Lizard Range
- Military Ground Support Area
- BMGR Land Boundary
- Auxiliary Airfields

Flat-Tailed Horned Lizard Range

Figure 4-17

BMGR - INRMP - April 2002

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Sources: Rorabaugh et al. 1987; Rorabaugh 1997

horned lizard has been found throughout much of the BMGR while the regal horned lizard is currently known only from the western slopes of the Sand Tank Mountains in East TAC (B. Barry, unpublished data).

Cowles Fringe-toed Lizard

Status: The AGFD lists this species as a Wildlife of Special Concern in Arizona (1996 in preparation), although the subspecific *rufopunctata* designation is not recognized therein.

Background Information: The Cowles fringe-toed lizard, a subspecies of the Colorado Desert fringe-toed lizard, is found in extreme southwestern Arizona and adjacent northwest Sonora, Mexico (Stebbins 1985) on the east side of the Colorado River, mainly in and near the Yuma and Mohawk Dunes. This species is restricted to fine, loose, wind-blown sand of dunes, flats, and washes (Stebbins 1985; AGFD 1988). It is found in sparsely vegetated creosotebush scrub and other scrub habitats.

Cowles fringe-toed lizards are omnivorous and eat leaves, flowers, seeds, insects, and occasionally other lizards (Stebbins 1985). On the Mohawk Dunes, rodent burrows provide important habitat for escaping the heat. It is not known where the lizards go to avoid high temperatures in the Yuma dunes; studies have shown that temperatures that are lethal to the lizard are found at the lizard's burrowing depth capacity. Fringe-toed lizard predators include coyote, fox, loggerhead shrike, sidewinder rattlesnake, red tailed hawks, and possibly sand dune beetles and tarantulas (Hall and others 2001; Barry 2002d).

Human activities, particularly ORV use, alter dune processes and dune vegetation. This can cause erosion and dune destabilization. The Mohawk Dunes is the largest dune system closed to recreational ORV use in the United States. The BMGR portion of the Yuma Dunes and the Pinta Sands on the Cabeza Prieta NWR, which are both also closed to recreational ORV use, are important for the U.S. population of the lizards and may become even more crucial in the future if adjoining habitat in the Gran Desierto in Mexico becomes threatened. Another threat to lizard populations is the dense growth of invasive plant species on the sandy soils of the dunes, which displaces native vegetation and attracts fewer insect herbivores. The dense growth of these plants hinders the ability of the lizards to forage and escape predators, and may alter food abundance. The military is not currently a threat, as the Mohawk and Yuma dunes are outside of military use areas (Hall and others 2001).

Populations in Study Area: On the BMGR, this lizard is found in and adjacent to the Mohawk and Yuma dunes (AGFD 1996). The preferred habitat on the Yuma Dunes is swales (low points on dunes), which have more vegetation than the unvegetated ridgelines. Conversely, in the Mohawk Dunes the lizards are found on the dune ridgelines and not the swales because the soils

of the Mohawk Dune swales are much more stable than those of the Yuma Dunes and have a microbiotic soil crust (Hall and others 2001).

Sonoran Population of the Desert Tortoise

Status: The AGFD includes the Sonoran population of the desert tortoise in the list of Wildlife of Special Concern in Arizona (1996 in preparation).

Background Information: The Sonoran population of the desert tortoise includes tortoises that occur south and east of the Colorado River. In Arizona, they range from the Kingman area in Mohave County south to the Chocolate Mountains (Arizona), and southeast as far as the San Pedro River. In southern Arizona, desert tortoises occur primarily on rocky slopes and bajadas of the Arizona Upland and Lower Colorado subdivisions of the Sonoran Desert (Schneider 1981; Vaughan 1984). They most often occur in paloverde-mixed cacti associations (Vaughan 1984). Within the Arizona Upland Subdivision, tortoises are most commonly found in areas with boulders, outcrops, and natural cavities that provide coversites. Vaughan (1984) reported that home range sizes of tortoises in upland habitats of the Picacho Mountains in Arizona range between 8 and 135 acres. Desert tortoises have been found as far as 3 miles away from the mountains on the middle bajadas in association with caliche caves along major arroyos. Burrows and caliche caves are important for tortoise viability and for maintaining constant temperature and relative humidity. Eastern and northern slopes are used during the summer months. Because these slope aspects are exposed during summer to the direct sun for shorter periods compared with other aspects, they provide relatively cool and mesic conditions. Tortoises hibernate, however, on southern and western slopes because these exposures provide relatively warm conditions during the winter (Hall and others 2001).

Populations in Study Area: Surveys conducted in the Sand Tank, Sauceda, and Aguila mountains, and the Crater Range of BMGR—East identified tortoise sign in all mountain ranges except for the Aguila Mountains (Dames & Moore 1996). Tortoise sign was most often observed along ridgelines and on rolling terrain at the base of steep slopes; tortoises or sign were never observed on intermountain flats. The Sand Tank Mountains support a relatively large population of tortoises compared to other BMGR mountain ranges surveyed, but this population density is moderate in comparison to other areas in Arizona (Dames & Moore 1996, Hall and others 2001). Based on surveys conducted by the BLM (Goodman 1992), extremely low numbers of tortoises may occur in mountains west of the San Cristobal Valley as indicated by sign noted in surveys of the Mohawk and Tinajas Altas mountains.

Great Plains Narrow-mouthed Toad

Status: This species is listed in the AGFD's Wildlife of Special Concern in Arizona (1996 in preparation).

Background Information: This toad ranges throughout most of the Great Plains to northern Mexico, east to the Gulf of Mexico, and west to the Sea of Cortez, then north into south-central Arizona. The occurrence of this species in Arizona is limited mainly to the Tohono O'odham and Gila Indian reservations and in and near the Patagonia and Pajarito mountains from sea level to approximately 4,100 feet. In Arizona, these toads occupy habitats ranging from desert grasslands to oak woodlands, but are more common in terrestrial than aquatic habitats. They are found in deep, moist crevices or burrows, often with various rodents, and under large flat rocks, dead wood, and other debris, near streams, seeps, and ephemeral pools. Recent AGFD Heritage-funded surveys have confirmed that Great Plains narrow-mouthed toads still occur at most historical localities in Arizona (Wallace 2001).

Populations in Study Area: The Great Plains narrow-mouthed toad is known to occur in the Vekol Valley immediately east of the BMGR. No surveys for this species have been conducted on the BMGR.

Protected Plants

Acuña Cactus

Status: The acuña cactus is a federal candidate (64 Federal Register 57533, dated 25 October 1999) and is Highly Safeguarded under the Arizona Native Plant Law (Arizona Department of Agriculture 1999).

Background Information: The species' distribution includes Arizona, and Sonora, Mexico (Heil and Melton 1994, R. Johnson 1992). Acuña cacti are up to seven inches high and four inches in diameter. Spines are reddish and about one inch long, arranged in groups consisting of two to four central spines with 11 to 15 radial spines (Geraghty & Miller and SWCA 1997). Flowers are pink to white and fruits are green, maturing to a tannish color (Dames & Moore 1996).

The acuña cactus is found in limestone hills and flats between 1,300 and 2,600 feet elevation (Heil and Melton 1994), although records indicate this species may be found as high as 2,700 feet above sea level (Taylor 1997). It occupies well-drained knolls and gravel ridges between major washes in the paloverde-saguaro association of Sonoran desertscrub (Benson 1969; Phillips and others 1982).

Populations in Study Area: A survey of 560 acres in BMGR—East located only one acuña cactus (Geraghty & Miller and SWCA 1997). Two populations, ranging from about 23 to 33 mature and 6 to 17 immature cacti, were found one-third mile south of the BMGR boundary. These cacti, located by Geraghty & Miller and SWCA (1997), were found on pale pink-gray ryolitic gravel and rock. In addition, acuña cacti were recently confirmed present in the Area A portion of the Sonoran Desert NM, which formerly comprised the northeast corner of the BMGR (Dahlem 2002b), and additional individuals may occur within the BMGR.

Peirson's Milkvetch

Status: This species is listed as federally threatened without determination of critical habitat (63 Federal Register 53596 dated 6 October 1998). In the final rule, Arizona was not recognized in either the current or historic range of the plant. Although this species is not currently listed by the Arizona Department of Agriculture (1999), it is nonetheless regarded as Highly Safeguarded under the Arizona Native Plant Law because federally listed plants resident to Arizona fall within this protected category.

Background Information: This species grows on the slopes and hollows of windblown dunes in the Sonoran Desert. According to Munz and Keck (1959) and Barneby (1964), it is known from the Borrego Valley, in San Diego County, and the Algodones Dunes, in Imperial County, which extend just south of the international border into northeastern Baja California (WESTEC 1977). It has also recently been found from the Gran Desierto in Sonora, Mexico (USFWS 1998b) and in BMGR—West. The plant and its habitat or potential habitats in Arizona have been largely protected from human activities due to restrictions on public access to the BMGR, the remoteness and difficulty of accessing the area, and the lack of military operations in the vicinity. ORV use is probably the primary human caused effect on the species, although on the BMGR such use is limited. Potential threats to Peirson's milkvetch in the Yuma Desert is invasion of nonnative plants, particularly Sahara mustard, which may compete with Peirson's milkvetch, or that may become dense enough in some years to carry fire (USFWS 2001b). One population of scattered Peirson's milkvetch, spanning the length of the Algodones Dunes system primarily along its western extant side, represents the largest distribution of this species in the United States. Managed by the BLM, the Algodones Dunes, also known as the Imperial Sand Dunes Recreation Area, are the most intensively used ORV recreation area in California's deserts, attracting several hundred thousand ORV users each year (USFWS 1998b) However, recently the BLM has curtailed recreation use in certain areas of the Imperial Sand Dunes in order to provide adequate protection of the Pierson's milkvetch (Schoeck 2001).

Populations in Study Area: A specimen of Peirson's milkvetch plant was found in low, partially stabilized dunes of the Yuma Desert in the southern portion of BMGR—West in 1996. Informal searches for the plant in 2001 at the Yuma Dunes, Pinta Sands, and near the collection site have not located additional plants (USFWS 2001b). This species is only apparent in years where

precipitation has been sufficient to support germination and growth. Such conditions are evidently uncommon on the BMGR as the species was not recorded in surveys by Warren and Laurenzi (1987) or Rorabaugh and others (1987).

Sand Food

Status: This species is a Highly Safeguarded species under the Arizona Native Plant Law (Arizona Department of Agriculture 1999).

Background Information: Previously known as *Ammobroma sonorae*, sand food is a leafless, parasitic plant that attaches itself to the roots of such plants as white bursage, dune buckwheat, and arrow weed (Nabhan 1980). The stem is an extremely succulent plant part that historically was an important food source for the Tohono O'odham. The flowering stalk surfaces from May through March. Sand food is restricted to active dune chains produced by wind transport of sand from beaches of prehistoric Lake Cahuilla and the Colorado River delta (AGFD 1996). These occur in the Gran Desierto in northwestern Sonora and the adjacent corners of Arizona, California, and Baja California (Warren and Laurenzi 1987).

Populations in Study Area: Reichenbacher and Duncan (1989) indicate that this species does occurs on sand dunes in the extreme southwestern corner of the BMGR, but that it is unlikely to occur as far north as the Mohawk Dunes. Several sand food plants were located on the range southwest of AUX-2 in May 1994 (Gilbert 1996).

Individual Crested Saguaros

Status: This type of saguaro is listed as a Highly Safeguarded species under the Arizona Native Plant Law (Arizona Department of Agriculture 1999).

Background Information: Crested (or cristate) saguaro result from an abnormal growth that results in a fan-topped growth pattern as actively proliferating tissue at the growing tip of the cactus broadens from its normal point into a line of dividing cells. The cause is unknown, other than it usually seems to follow damage to the growing point. It does not harm the plant, which frequently continues to produce flowers and fruit. Crests are occasionally found in nearly all plant species; the phenomenon is especially noticeable in saguaros because of their size. Crested saguaros are rare, estimated to occur in one out of 100,000 saguaros (Phillips and Comus 2000).

Populations in Study Area: Individual crested saguaros are known to occur on the BMGR, but have not been surveyed.

Other Plants Protected by the Arizona Native Plant Law

In addition to Highly Safeguarded plants, there are three other categories of plants that are protected by the Arizona Native Plant Law.

Salvage restricted plants found on the BMGR are all cacti, kearney sumac, blue sand lily, desert agave, Bigelow beargrass, elephant tree, *Dudleya arizonica*, Mexican jumping bean, Jerusalem thorn (also known as Mexican paloverde), ocotillo, bluedicks, Ajo lily, *Triteleiopsis palmeria*, Arizona rosewood, and crucifixion thorn (Arizona Department of Agriculture 1999).

Salvage assessed plants found on the BMGR include desert willow, blue paloverde, foothills paloverde, ironwood, honey mesquite, velvet mesquite, and smoke-tree (Arizona Department of Agriculture 1999). Most of these species are widely scattered on the BMGR; therefore, locations cannot be meaningfully mapped.

Harvest Restricted plants on the BMGR are ironwood, honey mesquite, velvet mesquite, and Bigelow beargrass (Arizona Department of Agriculture 1999). Most of these species are widely scattered on the BMGR.

4.7.2 Interrelationship Between the Military Mission and Protected Species

The compliance and stewardship responsibilities of the military with regard to protected species on the BMGR translate into important opportunities and constraints in management and use of the BMGR. To the extent feasible, compliance with the Endangered Species Act and similar protective state laws occurs in such a fashion as to not impede mission activities. However, it is sometimes deemed necessary to make certain concessions in activities related to the military mission in order to meet legal requirements related to protected species. There are both general mandates for conservation as well as duties to avoid jeopardy of endangered and threatened species, much of which is determined through consultation with the USFWS and other wildlife management agencies. As a result of consultation, specific compliance measures may be designed to identify, assess, or avoid impacts to protected species and are developed as a result of potential impacts of specific mission requirements. Other management practices, though, are implemented to prevent unnecessary conflicts between military operations and resource protection requirements.

Military operations potentially affecting protected species are essentially the same as those that affect general wildlife and wildlife habitat. These activities include habitat disturbance from road use and maintenance, target area maintenance, use of vehicles off road to clean up ordnance and debris from targets, noise and impact craters from ordnance delivery, noise from aircraft operations, and the use of designated support areas by ground troops. These operations are limited to areas of current use and prior disturbance (see Section 4.6.2). However, in correlation

with compliance requirements, substantially more effort and attention is focused on assessing and minimizing the potential impacts of these activities on protected species. Some illustrative examples are provided in the paragraphs that follow, but this discussion is by no means intended as a complete account of the interrelationship between BMGR protected species and the military mission.

The primary example of the interrelationship between the military mission and protected species on the BMGR is that of the endangered Sonoran pronghorn. This interrelationship is multifaceted and complicated by many factors. First, there is the historical fact that the military land withdrawal has had the effect of protecting Sonoran pronghorn habitat while other (non-military) actions and climatic factors have reduced the range and size of the Sonoran pronghorn population to its current endangered status. The limited range of this subspecies, its division into three isolated subpopulations, and its relatively small population size exacerbates the effects of current actions within Sonoran pronghorn range. The continued survival and recovery of the Sonoran pronghorn revolves principally around the extent to which its remaining available habitat is protected from further loss or degradation; the capacity of that habitat to support and sustain the growth of a larger population; the advancing age of the U.S. population; and the degree to which its population is threatened with the loss or harm of its individual members through direct death or injury, harassment, and suppressed fawn recruitment.

Although discussed at greater length in Section 4.7.3.2, how compliance with the Endangered Species Act is interrelated with the military mission is briefly illustrated herein with the example of Sonoran pronghorn. In accordance with Section 7(a)(2) of the Endangered Species Act, the Air Force and Marine Corps must consult with the USFWS to ensure that their actions are not likely to jeopardize the continued existence of the Sonoran pronghorn. Through consultation with the USFWS, it has been determined that the Air Force and Marine Corps actions on the BMGR are not likely to jeopardize the continued existence of this subspecies. The USFWS determined a specified level of incidental take (i.e., take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity) of Sonoran pronghorn and provided mandatory reasonable and prudent measures to minimize the impacts of incidental take of Sonoran pronghorn. The reasonable and prudent measures and implementing terms and conditions that the Air Force and Marine Corps have been mandated to implement with regard to Sonoran pronghorn are varied and continue to require modification of military mission activities. For example, the HE target areas in Sonoran pronghorn range are monitored prior to the delivery of live ordnance and if Sonoran pronghorn are detected in the vicinity, training missions are diverted or cancelled. These mandated requirements are subject to change and require repeated revision based on new information, improved scientific understanding, or legal decisions.

In addition to such mandatory requirements, Section 7(a)(1) of the Endangered Species Act requires the Air Force and Marine Corps to utilize their authorities in furtherance of the purposes of the Act. Carrying forward the example of the interrelationship of the military mission and Sonoran pronghorn conservation, this requirement, in effect, renders the military as an active

participant in the recovery of the Sonoran pronghorn. Meeting these conservation program-related requirements of the Endangered Species Act, however, is not as stringent as those of Section 7(a)(2) as they are at the discretion of the military and not dictated by the USFWS. However, as is common, the USFWS has made non-binding suggestions to the Air Force and Marine Corps during the course of consultation that (1) identify discretionary measures that the Air Force and Marine Corps can take to minimize or avoid the adverse effects on Sonoran pronghorn; (2) identify studies, monitoring, or research to develop new information on Sonoran pronghorn; and (3) include suggestions on how an action agency can assist Sonoran pronghorn conservation as part of their action and in furtherance of their authorities under Section 7(a)(1) of the Endangered Species Act. In some cases, the Air Force and Marine Corps have incorporated such suggestions as an integral part of the proposed action as conservation measures. Implementation of other suggestions that are not incorporated in the proposed action, but are included in the biological opinion, are at the discretion of the Air Force and Marine Corps. Many of these suggested measures focus on the collection of data to better understand the effects of military training on this subspecies.

Most of the USFWS suggestions resulting from the most recent Air Force and Marine Corps consultation with the USFWS regarding Sonoran pronghorn were adopted by the Air Force and Marine Corps as conservation measures. For example, the USFWS recommended that the military provide the funds and/or manpower to accomplish 23 of the 51 recovery actions identified by the Sonoran Pronghorn Recovery Team. As shown in Table 4-21, 15 of these were identified for Air Force assistance, 14 for Marine Corps assistance, and five were identified for both Air Force and Marine Corps assistance. The Air Force included a conservation measure to assist with the 15 identified recovery actions while the Marine Corps included a conservation measure to support a “fair share” of the 51 recovery actions. USFWS suggestions not adopted as Air Force or Marine Corps conservation measures remain discretionary USFWS conservation recommendations. An example of a USFWS conservation recommendation resulting from the recent Air Force biological opinion is for the Air Force to study the feasibility of moving or adding targets north of the Crater Range for use when tactical range targets are closed due to the presence of Sonoran pronghorn. Other conservation measures and conservation recommendations for Sonoran pronghorn and other federally protected species resulting from Endangered Species Act consultation are further discussed in Section 4.7.3.2.

Another specific example that illustrates the fundamentals of this interrelationship surrounds the recent *Study of the Long-term Noise Effects of Military Overflights on the Sonoran Pronghorn* by Krausman and others (2001). This study was initiated as a result of Air Force consultation with the USFWS for ongoing use of the BMGR for training in 1996. This study was commissioned with the goal of determining the long-term effects of military aircraft noise on the Sonoran pronghorn, including reproductive effects and effects on fawn survival. As detailed in Section

1

TABLE 4-21
SONORAN PRONGHORN RECOVERY ACTIONS IDENTIFIED BY THE RECOVERY TEAM THAT BECAME CONSERVATION MEASURES/CONSERVATION RECOMMENDATIONS FOR THE AIR FORCE AND MARINE CORPS VIA USFWS BIOLOGICAL OPINIONS

Ranking		Sonoran Pronghorn Recovery Action	Air Force	Marine Corps
Priority	Average			
1	1.00	Maintain active radio collars on ~10 percent of the Sonoran pronghorn population for population monitoring and other study purposes		
2	1.18	Experimentally place small, portable, temporary waters in occupied habitat during the summer months, and evaluate their use and efficacy	✓	
3	1.18	Develop a white paper that addresses the full range of captive breeding alternatives (e.g., capture alternatives; age an d sex of wild caught animals; husbandry requirements, herd monitoring, holding facilities, transportation, release criteria, need for predator control, post-release monitoring, and etc.)		✓
4	1.18	Continue biennial, or possibly annual, population survey of the U.S. subpopulation		
5	1.18	Continue weekly aerial monitoring of radio collared pronghorn (i.e., distribution, movements, mortality signals, fawn status, predator presence)		✓
6	1.27	Develop an intensive monitoring program to quantitatively investigate pronghorn use of water tanks (i.e., permanent, semi-permanent, temporary, emergency)	✓	✓
7	1.27	Continue monitoring fawn recruitment while conducting weekly telemetry flights		
8	1.27	Implement and monitor experimental forage enhancement project on BMGR	✓	
9	1.36	Identify, evaluate, and prioritize potential reintroduction sites in the U.S. and Mexico		
10	1.36	Initiate biennial population surveys for the two Mexico subpopulations to be timed in conjunction with the U.S. survey		
11	1.45	Continue monitoring (and closing as needed) of military targets, relative to pronghorn locations, by contract biologists on North TAC and South TAC on BMGR on live fire days	✓	✓
12	1.45	Continue ongoing program of hauling water as needed to permanent tanks in currently occupied pronghorn habitat (e.g., Jose Juan Charco, Halliwill Catchment, etc.) until proposed pronghorn/water investigations are conducted and program can be quantitatively reevaluated		
13	1.73	Develop a study looking at seasonal diets (e.g., fecal analysis)	✓	
14	1.73	Continue restrictions on types of use in important pronghorn habitat during critical periods of the year (e.g., Organ Pipe Cactus NM periodic seasonal closure of Pozo Nuevo Road; Cabeza Prieta NWR closure to public use of Chico Shunie Loop Road, Marine use of certain ground sites on BMGR)	✓	✓
15	1.73	Contract with a population geneticist or American Zoological Association to conduct an analysis of what comprises a minimum population in order to maintain the gene pool and to assess at what point, if the U.S. subpopulation continues to decline, all remaining pronghorn should be taken into captivity		
16	1.82	Initiate study by AGFD to evaluate effects of Border Patrol helicopter flights on pronghorn		
17	1.91	Develop study to investigate potential contaminant concerns from military activities on BMGR (e.g., soil/vegetation sampling; blood and tissue samples from captured pronghorn; sampling of other resident wildlife) for baseline data	✓	
18	1.91	Continue aggressively investigating and documenting all incidences of mortality (collared and uncollared) and likely causes		

TABLE 4-21
SONORAN PRONGHORN RECOVERY ACTIONS IDENTIFIED BY THE RECOVERY TEAM THAT BECAME CONSERVATION MEASURES/CONSERVATION RECOMMENDATIONS FOR THE AIR FORCE AND MARINE CORPS VIA USFWS BIOLOGICAL OPINIONS

Ranking		Sonoran Pronghorn Recovery Action	Air Force	Marine Corps
Priority	Average			
19	1.91	Deploy remote data loggers as needed to document use of water sources, travel corridors, and/or foraging areas by radio collared pronghorn	✓	
20	1.91	Initiate AGFD/Air Force study to evaluate effects of night missions on pronghorn behavior/activity		
21	1.91	Experimentally mark a sample of coyotes with a global positioning system collars to determine behavior and seasonal movements relative to pronghorn locations, free water, rainfall events		✓
22	2.00	Develop a study to monitor/investigate influences of disease and other stressors on pronghorn		
23	2.00	Assess effectiveness of current aerial population survey methodology and compare with current literature		
24	2.00	Continue law enforcement activities designed to reduce illegal border traffic (e.g., foot and vehicle of undocumented aliens, drug smuggling) and as a consequence of movement through pronghorn habitat		
25	2.09	Investigate *Culicoides sp*. as a vector source in the transmission of bluetongue and Epizootic Hemorrhagic Disease (EHD) to pronghorn from cattle and other native ungulates		
26	2.09	Continue field work by University of Arizona and preparation of vegetation association map for Organ Pipe Cactus NM, BLM, Cabeza Prieta NWR, BMGR	✓	✓
27	2.09	Develop a water balance study (e.g., double-labeling, water deprivation, use of preformed/metabolic water in diet) using a surrogate race of captive pronghorn		✓
28	2.09	Expand genetic determinations to include Mexico as opportunity allows (e.g., Peninsular pronghorn and Sonoran subpopulations)		
29	2.18	Investigate impacts of helicopters from other program activities (e.g., Marine Corps Weapons Tactics Instructor course, other military activities, U.S. Customs Service, other State and Federal management agencies) on pronghorn		
30	2.18	Initiate periodic aerial surveys in Mexico at other times of the year than the population census to monitor herd size, composition, distribution, natality, etc.		
31	2.18	Investigate effects of public use and other ground-based activity (e.g., military training, ordnance clean-up, law enforcement, land management agency activities such as grazing, firewood cutting, and mining) on pronghorn	✓	
32	2.18	Complete AGFD contract with Purdue University to look at taxonomic status using established genetic markers of Sonoran pronghorn relative to other races of pronghorn		
33	2.27	Continue to promptly notify Cabeza Prieta NWR of all pronghorn mortalities; recovery team leader keeps a file on all reports and maintains a summary table of all mortalities and known facts	✓	
34	2.27	Incorporate a habitat assessment component in currently used population survey technique to monitor annual change/variation in range condition	✓	
35	2.27	Complete range assessment of four allotments by the BLM and application of Standards and Guidelines to ensure adequate forage for pronghorn and habitat improvement		✓
36	2.27	Evaluate pronghorn location data relative to available habitat using normalized digital vegetation index and/or other forms of satellite data	✓	✓
37	2.36	Develop a narrowly-defined and rigidly controlled coyote removal plan		

TABLE 4-21
SONORAN PRONGHORN RECOVERY ACTIONS IDENTIFIED BY THE RECOVERY TEAM THAT BECAME CONSERVATION MEASURES/CONSERVATION RECOMMENDATIONS FOR THE AIR FORCE AND MARINE CORPS VIA USFWS BIOLOGICAL OPINIONS

Ranking		Sonoran Pronghorn Recovery Action	Air Force	Marine Corps
Priority	Average			
38	2.36	Develop study to continue to evaluate water quality at bomb craters that fill with water and are frequented, at least seasonally, by pronghorn		✓
39	2.36	Update the Population Viability Analysis in light of new, more quantified data on various aspects of pronghorn biology and Population Viability Analysis techniques		✓
40	2.36	Evaluate occurrence of bluetongue and EHD in cattle and native ungulate species and their potential to serve as a reservoir for these diseases		
41	2.45	Fix highway (e.g., State Route 85, Interstate 8), International Boundary, and other fences to make them pronghorn accessible or pronghorn barriers as determined necessary		
42	2.45	Prepare a written protocol for dealing with injured or dead pronghorn including permit authority, agency and veterinarian contact numbers, notification protocol, transportation, housing and/or disposal procedures		
43	2.55	Compile extant reports of pronghorn watering (documented and anecdotal), review of literature, and prepare a technical reviewed article		
44	2.55	Continue timely coordination with Recovery Team and Phoenix Ecological Services Office on all proposed use changes on tactical ranges	✓	✓
45	2.55	Investigate blank spots in current pronghorn range distribution maps (e.g., targeted aerial surveys, remote sensing)		
46	2.55	Experimentally provide mineral supplement blocks	✓	
47	2.55	Conduct a comprehensive literature review of pronghorn/barrier interactions and wildlife passage devices and designs (to include literature for other ungulate species when appropriate)		
48	2.63	Develop a back-up plan in the event of a hoof and mouth outbreak		
49	2.7	Construct and staff a Sonoran Desert greenhouse for producing key forage plants for transplanting		
50	2.7	Assess all wildlife and livestock waters on four BLM allotments as to pronghorn accessibility and/or potential traps		
51	2.9	Develop a medical kit with all necessary materials for treatment, salvage, and/or necropsy with description of procedures and handling of biological samples		✓

Each recovery team member assigned a rank of high = 1, medium = 2, or low = 3 to each project. Since there are 51 projects and 3 rankings, exactly 1/3 of the projects were ranked high, medium, or low by individual team members. The assigned rankings were averaged and the lower the score, the higher the priority. In the event of a tie between 2 or more projects, the project with the lowest variance was ranked higher. The theoretical highest and lowest possible rank that can be achieved by a given recovery action is 1.0 and 3.0, respectively.

Air Force and/or Marine Corps proposes to assist with funding or staffing (per the current Biological Opinions, the 15 recovery actions indicated for the Air Force are included as an Air Force conservation measure; the Marine Corps conservation measure is to assist with a "fair share" of these recovery actions and the 14 recovery actions identified for the Marine Corps are specified as USFWS conservation recommendations.)

Source: USFWS 2001a, 2001b.

4.7.1.3, although these researchers found that military activity is associated with changes in the behavior of pronghorn, they concluded that these changes were not likely to affect Sonoran pronghorn in a detrimental manner. These researchers were not able to determine the extent of effect from short-term and/or intermittent annoyances that occur during times when Sonoran pronghorn are particularly sensitive (such as during the fawning season [February through May], or during the hot and dry summer months [drought] that precede the monsoon [typically May through July]). However, additional information regarding the effects of military activities on Sonoran pronghorn during the fawning season is expected to result from the forage enhancement studies and the ongoing weekly overflight surveys. Additionally, in light of the findings of Krausman and others (2001), the military made several changes to their operations in order to lessen these impacts, such as rescheduling tactical range maintenance and cleanup activities to occur outside of these sensitive seasons. These changes were formalized in consultation with the USFWS in 2001.

The preliminary results of a separate study examining habitat use by Sonoran pronghorn on the BMGR from 1999 to 2001 illustrate another interrelationship between the military mission and Sonoran pronghorn. These preliminary results indicate that disturbed habitat on the BMGR at military use areas may attract Sonoran pronghorn by creating favorable forage and viewing conditions in a vegetative monotypic environment. These findings were based on overlying data of Sonoran pronghorn sightings with vegetation association and disturbance status (e.g., mock airfields, road, target) identified for 344 one-kilometer blocks within North and South TAC. Sightings were biased toward disturbed blocks with 70 percent of Sonoran pronghorn locations (301 out of 433) occurring in proximity to mock airfields, HE hills, roads, and other targets. The Sonoran pronghorn were located within vegetation association in proportion to availability. However, the results indicate that Sonoran pronghorn use of disturbed habitat was disproportionate to availability. The proportion of Sonoran pronghorn locations within blocks that had sustained recent burns was also disproportionate to availability. Environmental manipulations simulating the effects of some military disturbance on the landscape may improve remaining Sonoran pronghorn habitat (Krausman and others 2002 in preparation).

The Marine Corps participation in the conservation agreement for the flat-tailed horned lizard is a good example of management practices that have prevented unnecessary conflicts between protected species and the military mission. In large part because of the conservation agreement, the flat-tailed horned lizard was withdrawn from proposed listing as federally threatened in 1996. Although a 2001 court decision has led the USFWS to reconsider the proposed listing of this species again, this species' habitat within the BMGR is considered the most protected portion of this species' range (Hall and others 2001). Even if the species is consequently listed, the proactive actions of the military to restrict military and recreational activities from flat-tailed horned lizard habitat is expected to minimize conflicts between the protection of this species and accomplishment of the military mission.

Finally, in addition to the effects of military activity, the effects of recreational use of the BMGR on protected species must also be considered. For example, the recent round of consultations between BMGR managing agencies and the USFWS regarding the Sonoran pronghorn has resulted in the partial closing of portions of the BMGR to the public during the fawning season (15 March to 15 July) that were previously open to recreation to avoid potential impacts on Sonoran pronghorn.

4.7.3 Existing Regulatory and Statutory Requirements and Management Plans and Actions

4.7.3.1 Regulatory and Statutory Requirements

Arizona Native Plant Law

The Arizona Native Plant Law, which became effective in 1993, is administered by the Plant Industries Division of the Arizona Department of Agriculture.

Highly safeguarded species are those whose prospects for survival are in jeopardy or which are in danger of extinction. The sale or offering for sale, delivery, receiving, carrying, or transporting in interstate commerce of highly safeguarded plants, including seeds and fruits, is prohibited. Permits, tags, and seals are needed for collection for scientific purposes or noncommercial salvage where plants' existence is threatened. Joint application by the landowner and salvage operator or collector is needed for a salvage permit.

Salvage restricted plants are protected, but not the seeds or fruit. Commercial harvest or salvage is permitted with appropriate permits and tags, and only by a joint application made by the landowner and salvage operator. The removal of salvage assessed plants for sale requires an annual salvage permit and the use of salvage tags and seals. The permit does not require application by the landowner, but only by the commercial collector.

Harvest restricted plants require harvest permits and wood receipts for collecting of wood or leaves in excess of 100 pounds or two cords of wood. A joint application by the landowner and operator is needed. It is unlawful for a person to take, transport or possess a harvest restricted plant for its by-products, fiber or wood, if he or she is not in possession of a permit and any required receipts. A person in possession of a valid permit for the removal of dead plants or parts issued by the U.S. Department of Agriculture or Interior from lands under the appropriate agency is exempt from the permit required by the state. Specifically exempted is use of dead wood for permissible campfires.

Currently, plant collection and salvage on the BMGR is allowed only in situations where plants are being salvaged prior to disturbance (such as a new access road). These salvage actions are to be accomplished in coordination with the Arizona Department of Agriculture (U.S. DOI, BLM Yuma Field Office 1997 and AGFD 1997).

Migratory Bird Treaty Act (16 U.S.C. 703 et. seq.)

The MBTA implements various treaties and conventions between the United States and Canada, Japan, Mexico, and the former Soviet Union for the protection of migratory birds. Under the Act, taking, killing, or possessing migratory birds is unlawful. Only four bird species that occur on the BMGR are not included in the list of migratory birds protected by the MBTA (50 CFR 10.13). The MBTA governs the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests. The take of all migratory birds is governed by the MBTA's regulation of taking migratory birds for educational, scientific, and recreational purposes and requiring harvest to be limited to levels that prevent overutilization. Section 704 of the MBTA states that the Secretary of the Interior is authorized and directed to determine if, and by what means, the take of migratory birds should be allowed and to adopt suitable regulations permitting and governing take. The Secretary, in adopting regulations, is to consider such factors as distribution and abundance to ensure that take is compatible with the protection of the species.

Proposed amendments to the list of species protected under the MBTA (66 Federal Register 52282 dated 12 October 2001) address a total of 109 species and would result in a net addition of 30 species to the list of migratory birds, bringing the species total to 862. The proposed amendments would have no change to those MBTA-protected species that occur on the BMGR.

Neotropical Migratory Bird Conservation Act of 2000 (Public Law 106-247)

Of the nearly 800 bird species known to occur in the United States, approximately 500 migrate among countries, and the large majority of those species, the neotropical migrants, winter in Latin America and the Caribbean. This law is for the purpose of (1) perpetuating healthy populations of neotropical migratory birds; (2) assisting in the conservation of neotropical migratory birds by supporting conservation initiatives in the United States, Latin America, and the Caribbean; and (3) providing financial resources and fostering international cooperation for those initiatives. It directs the Secretary of the Interior to, among other things, support and coordinate existing efforts to conserve neotropical migratory bird species through facilitating meetings and promoting the exchange of information among persons involved in such efforts; developing and entering into agreements with other federal, foreign, state, and local governmental agencies, and nongovernmental organizations; and allowing for the convening of

an advisory group consisting of individuals representing public and private organizations actively involved in the conservation of neotropical migratory birds.

Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds

This Executive Order, dated 10 January 2001, directs federal agencies taking actions that have, or are likely to have, a measurable negative effect on migratory bird populations to develop and implement, within two years, a Memorandum of Understanding with the USFWS that shall promote the conservation of migratory bird populations. The order outlines specific requirements of the Memorandum of Understanding including schedule for completion, protocols for implementation, an elevation process for dispute resolution, and advising the public of the availability of its Memorandum of Understanding through a notice published in the Federal Register.

Notwithstanding the requirement to finalize a Memorandum of Understanding within two years, each agency is encouraged to immediately begin implementing the following, as appropriate and practicable:

(1) integrate bird conservation principles, measures, and practices into agency activities and avoid or minimize adverse impacts on migratory bird resources when conducting agency actions
(2) restore and enhance the habitat of migratory birds
(3) prevent or abate the pollution or detrimental alteration of the environment for the benefit of migratory birds
(4) design migratory bird habitat and population conservation principles, measures, and practices into agency plans and planning processes and coordinate with other agencies and nonfederal partners in planning efforts
(5) ensure that agency plans and actions promote programs and recommendations of comprehensive migratory bird planning efforts such as Partners in Flight as well as guidance from other sources
(6) ensure that NEPA or other established environmental review processes evaluate the effects of actions and agency plans on migratory birds
(7) provide notice to the USFWS in advance of conducting an action that is intended to take migratory birds, or annually report to the USFWS on the number of individuals of each species of migratory birds intentionally taken during the conduct of any agency action, including but not limited to banding or marking, scientific collecting, taxidermy, and depredation control
(8) minimize the intentional take of species of concern by: (i) delineating standards and procedures for such take; and (ii) developing procedures for the review and evaluation of take actions

(9) identify where unintentional take reasonably attributable to agency actions is having, or is likely to have, a measurable negative effect on migratory bird populations; develop and use principles, standards, and practices that will lessen the amount of unintentional take; inventory and monitor bird habitat and populations to facilitate decisions about the need for, and effectiveness of, conservation efforts
(10) control the import, export, and establishment in the wild of live exotic animals and plants that may be harmful to migratory bird resources
(11) promote research and information exchange related to the conservation of migratory bird resources, including coordinated inventorying and monitoring and the collection and assessment of information on environmental contaminants and other physical or biological stressors having potential relevance to migratory bird conservation
(12) provide training and information to appropriate employees on methods and means of avoiding or minimizing the take of migratory birds and conserving and restoring migratory bird habitat
(13) promote migratory bird conservation in international activities and with other countries and international partners, in consultation with the Department of State, as appropriate or relevant to the agency's authorities
(14) recognize and promote economic and recreational values of birds
(15) develop partnerships with non-federal entities to further bird conservation

DoD American Indian and Alaska Native Policy

This policy statement, dated 20 October 1998, establishes a broad-based approach for interacting and working with federally recognized American Indian and Alaska Native governments. With regard to natural and cultural resources, the policy set forth is to recognize and respect the significance tribes ascribe to certain natural resources and properties of traditional or customary religious or cultural importance by:

- Undertaking DoD actions and managing DoD lands consistent with the conservation of protected tribal resources and in recognition of Indian treaty rights to fish, hunt, and gather resources at both on- and off-reservation locations

- Enhancing, to the extent permitted by law, tribal capabilities to effectively protect and manage natural and cultural tribal trust resources whenever DoD acts to carry out a program that may have the potential to significantly affect those tribal trust resources

- Accommodating, to the extent practicable and consistent with military training, security, and readiness requirements, tribal member access to sacred and off-reservation treaty fishing, hunting, and gathering sites located on military installations

- Developing tribal specific protocols to protect, to the maximum extent practicable and consistent with the Freedom of Information Act, Privacy Act, NHPA, and ARPA, tribal information regarding protected tribal resources that has been disclosed to, or collected by, the DoD.

Although no species that occur on the BMGR are specifically protected by this policy at present, one goal of the of the ICRMP is to identify and address Native American concerns for heritage resources, and provide Native American access to heritage resources to the maximum degree consistent with Air Force/Marine Corps mission requirements (see Section 4.16.3 for more details). Thus, this policy, together with the ICRMP, could result in additional protection or specialized treatment for any identified species.

Endangered Species Act Section 7 Consultation Process

When evaluating actions potentially affecting threatened or endangered species, agencies need to take into account the requirements of the Endangered Species Act. Formal consultations with the USFWS pursuant to Section 7(a)(2) of the Endangered Species Act (50 CFR 402) are required prior to federal agencies authorizing, funding, or implementing proposed actions that *may adversely affect* a threatened or endangered species or its critical habitat. When federal activities *may affect* a threatened or endangered species or its critical habitat, informal consultation with the USFWS may be used to exchange information and resolve conflicts prior to a written request for formal consultation. Preparation of a biological assessment is required before initiation of formal consultation. Anywhere from a few weeks to more than a year may be required to finalize a biological assessment before it can be submitted to the USFWS as part of the request to initiate formal consultations. Formal consultations involve up to a 90-day consultation period, and an additional 45-day period for the USFWS to prepare a biological opinion (135 days total).

A biological opinion is a written statement from the USFWS regarding its opinion and a summary of the information on which the opinion is based, detailing how the agency action affects the species or its critical habitat. The biological opinion provides nondiscretionary reasonable and prudent measures that should be implemented in conjunction with a proposed action to avoid or minimize impacts. The USFWS also provides nonbinding conservation recommendations as part of the biological opinion.

In addition to being a component of the formal Section 7 process, a biological opinion is required for actions that may affect a threatened or endangered species to avoid violations under Section 9 of the Endangered Species Act. Section 9 of the Endangered Species Act prohibits the “take” of a threatened or endangered species without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the USFWS to include significant habitat modification

or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the USFWS as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2) of the Endangered Species Act, taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Endangered Species Act provided that such taking is in compliance with reasonable and prudent measures, and with their implementing terms and conditions. Terms and conditions are designed to minimize the impact of incidental take that might otherwise result from the action. If, during the course of the action, the anticipated level of take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. Federal agencies must immediately provide an explanation of the causes of the taking and review with the USFWS the need for possible modification of the reasonable and prudent measures.

The informal consultation process to fulfill Section 7 requirements generally requires less time than formal consultations. Informal consultation is an option when the incidental take of a threatened or endangered species can be avoided. This process can also be used to initiate a dialog with the USFWS regarding the necessity for formal consultation.

When a proposed action affects a species that is not listed, but is proposed for listing as threatened or endangered, a formal conference (as opposed to a consultation for a listed species) with the USFWS may be required. The standard for requiring a conference is that the proposed action may jeopardize the continued existence of the species, as opposed to affecting it.

4.7.3.2 Current USFWS Consultation Decisions

The most recent USFWS biological opinions and letters of concurrence for actions on the BMGR are presented in summary format in Table 4-22 and are briefly discussed below. Much of the information presented herein is in summary form and paraphrased. The summaries of the Air Force and Marine Corps consultation is more detailed that the summaries of the other agency consultations because these DoD consultation are more applicable to the development of the INRMP for the BMGR. USFWS biological opinions and consultation letters are available to the public and should be consulted for specifics.

TABLE 4-22
MOST RECENT USFWS BIOLOGICAL OPINIONS/CONCURRENCE LETTERS FOR BMGR ACTIONS

Agency	Date	Type	Consultation No.	Action	Species
Air Force	11/16/2001	BO	2-21-96-F-094-R1	Military Training Activities Administered by the U.S. Air Force on the BMGR	Sonoran pronghorn
	10/30/1997	Letter	2-21-96-F-094	Ongoing Military Training Activities within the Gila Bend Segment of the BMGR	Cactus ferruginous pygmy-owl, lesser long-nosed bat, American peregrine falcon
	8/27/1997	BO	2-21-96-F-094	Use of Ground-Surface and Airspace for Military Training on the BMGR	Sonoran pronghorn
Marine Corps	11/16/2001	BO	2-21-95-F-114-R2	Existing and Proposed Activities by MCAS Yuma on the Arizona Portion of the YTRC (BMGR)	Sonoran pronghorn and Peirson's milkvetch
	3/18/1998	BO	2-21-95-F-114-R1	Existing and Proposed Activities by MCAS Yuma on the Arizona Portion of the YTRC	Sonoran pronghorn, flat-tailed horned lizard, lesser long-nosed bat, cactus ferruginous pygmy-owl
	4/17/1996	BO	2-21-95-F-114	Existing and Proposed Activities by MCAS Yuma on the Arizona Portion of the YTRC	Sonoran pronghorn, flat-tailed horned lizard, lesser long-nosed bat, cactus ferruginous pygmy-owl
Army	11/16/2001	BO	2-21-92-F-227-R1 2-21-93-F-389-R1	Western Army National Guard Aviation Training Site Expansion Project	Sonoran pronghorn
	9/19/1997	BO	2-21-92-F-227 2-21-93-F-389	Western Army National Guard Aviation Training Site Expansion Project	Lesser long-nosed bat, American peregrine falcon, cactus ferruginous pygmy-owl
Border Patrol	11/16/2001	BO	2-21-96-F-334-R1	All Border Patrol Activities Currently Being Conducted by the Yuma Sector	Sonoran pronghorn
	9/5/2000	BO	2-21-96-F-334	All Border Patrol Activities Currently Being Conducted by the Yuma Sector	Sonoran pronghorn
BLM	3/4/1999	Letter	2-21-99-I-160	Barry M. Goldwater East Habitat Management Plan (plan never finalized)	Sonoran pronghorn, lesser long-nosed bat, cactus ferruginous pygmy-owl
	9/12/1997	Letter	2-21-97-I-055	Gila Bend to Ajo 230 kV Transmission Line Project (project never initiated)	Sonoran pronghorn, lesser long-nosed bat, cactus ferruginous pygmy-owl
	7/24/1997	Letter	2-21-96-I-278	Lechuguilla-Mohawk Habitat Management Plan	Sonoran pronghorn
	10/30/1989 4/25/1990	Letter BO	2-21-85-I-069 2-21-90-F-042	Lower Gila South Resource Management Plan (Goldwater Amendment)	Sonoran pronghorn, lesser long-nosed bat, and Tumomac globeberry

Air Force: Consultation No. 2-21-96-F-094

Consultation History: On 27 August 1997, the USFWS issued a biological opinion for Use of Ground-Surface and Airspace for Military Training on the BMGR relative to the renewal of the BMGR land withdrawal. That opinion found that the proposed action was not likely to jeopardize the continued existence of the Sonoran pronghorn. In addition, on 30 October 1997, the USFWS concurred with the Air Force's assessment that the proposed action may affect, but is not likely to adversely affect, the cactus ferruginous pygmy-owl, lesser long-nosed bat, and peregrine falcon. The USFWS concurrence with regard to the cactus ferruginous pygmy-owl, however, was predicated on the Air Force continuing to conduct pygmy-owl surveys, not destroying any potential pygmy-owl habitat, and notifying the USFWS if pygmy-owls are detected on the BMGR.

On 12 February 2001, the U.S. District Court for the District of Columbia remanded that portion of the biological opinion addressing Sonoran pronghorn (see Defenders of Wildlife, et al. v. Babbitt, et al., Civil Action No. 99-927 ESH [U.S. District Court for the District of Columbia 12 February 2001]). Accordingly, the USFWS issued Revision 1 to this biological opinion on 16 November 2001. The consultation process resulted in a non-jeopardy opinion for the Sonoran pronghorn.

Air Force Conservation Measures: With 2-21-96-F-094-R1, the Air Force proposed to implement various conservation measures for Sonoran pronghorn, which include the following (paraphrased):

- Modify the EOD tactical annual range maintenance schedule to further reduce potential effects to Sonoran pronghorn (East TAC from 15 March to 15 May, North TAC from 1 January to 28 February, and South TAC from 1 October to 15 December).
- Continue to brief all users on Sonoran pronghorn, the status of the species, the importance in reducing impacts to the species, and any mitigation measures that apply.

- Continue to restrict all vehicles to existing designated roads with the exception of personnel conducting necessary activities that require them to leave designated roads.
- Continue to limit the extent of new surface disturbance as much as possible for all new actions and confine them to existing roadways where feasible.
- Continue to implement low speed limits on roadways as appropriate.
- Continue Air Force funding for an ongoing study with AGFD to determine the effects of military night operations on Sonoran pronghorn.
- Complete a study in progress to determine the effects of military activities on Sonoran pronghorn during the fawning season.
- Continue to coordinate with the USFWS on all pronghorn studies and monitoring efforts.
- Update *"Operating Instruction 1.1, Sonoran Pronghorn Monitoring"* to include new procedures to (1) require that both North TAC and South TAC are monitored on the first

fly day of the week even if no live ordnance operations are scheduled for that day to ensure that the ranges are monitored at least weekly and (2) require a second day of monitoring on ranges when a Sonoran pronghorn was not sited on the first monitoring day, but had been sited there within seven days prior to provide two non-sighting days before monitoring of that range for the week ceases.

- Examine vehicle roads in currently occupied Sonoran pronghorn habitat and seasonally or permanently close unneeded routes. The San Cristobal Valley is closed to all recreation use. Access is permitted only with a special use permit issued by the Range Management Office. Additionally, close San Cristobal Valley to special use permits from 15 March – 15 June and permanently close approximately 163 miles of roads and trails in the Air Force portion of BMGR west of State Route 85 along with 32 miles of seasonal closures in coordination with the AGFD and the Border Patrol.
- Submit certain annual reports to the USFWS.
- Continue to assist in supporting research and active management to determine the limiting factors of this Sonoran pronghorn population. Fifteen of the 51 recovery projects identified by the Sonoran Pronghorn Recovery Team are identified (see Table 4-21).

Anticipated Take: With 2-21-96-F-094-R1, the USFWS anticipates that no more than three Sonoran pronghorn could be taken as an incidental result of the proposed action. The incidental take is expected to be one Sonoran pronghorn in the form of death and two Sonoran pronghorns in the form of harassment. It is stated that the incidental take provision will be reviewed concurrent with subsequent five-year reviews of the INRMP. The USFWS determined that this level of anticipated take is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

USFWS Reasonable and Prudent Measures: With 2-21-96-F-094-R1, the USFWS issued a non-discretionary, binding reasonable and prudent measure to "Expand efforts to monitor Sonoran pronghorn on the tactical ranges to minimize the likelihood of adverse impacts to the pronghorn from military training exercises." The non-discretionary term and condition issued to implement the reasonable and prudent measure described above was "Revise and implement the operating instruction on Sonoran pronghorn as detailed in the conservation measure regarding updating *Operating Instruction 1.1, Sonoran Pronghorn Monitoring.*"

USFWS Conservation Recommendations: The USFWS also recommends that the Air Force implement the following discretionary actions for the benefit of Sonoran pronghorn (paraphrased):

- Pursue funding for all research needs that are identified for implementation by the U.S. Air Force in the final revision of the *Sonoran Pronghorn Recovery Plan*, as well as all research needs that have been concurrently or subsequently identified by the Sonoran Pronghorn Recovery Team.

- Conduct and/or fund research to determine the effects of low-level flights by helicopters on free-ranging pronghorn and use the information to evaluate flight ceilings and low-level flight corridors over Cabeza Prieta NWR.
- Prepare a Sonoran pronghorn database from all historic sightings in Air Force files and support an annual program of documenting Sonoran pronghorn sightings.
- Study the feasibility of moving or adding targets north of the Crater Range for use when tactical range targets are closed due to the presence of Sonoran pronghorn.
- Continue efforts to implement the use of modular targets and electronic scoring systems and continue to evaluate the development of a sensor training area using no-drop, electronically scored, targets.

Marine Corps: Consultation No. 2-21-95-F-114

Consultation History: On 17 April 1996, the USFWS issued a biological opinion and conference opinion for existing and proposed activities by MCAS Yuma for the Arizona portion of the YTRC. The biological opinion addressed Sonoran pronghorn, flat-tailed horned lizard, lesser long-nosed bat, and cactus ferruginous pygmy-owl. The USFWS concurred with MCAS Yuma that the action was not likely to adversely affect the lesser long-nosed bat. The USFWS also conditionally concurred that the action was not likely to jeopardize the cactus ferruginous pygmy-owl, subject to the requirement that surveys be conducted. Non-jeopardy opinions were also issued for the flat-tailed horned lizard and the Sonoran pronghorn, but reasonable and prudent measures and implementing terms and conditions were applied and incidental take were anticipated for both of these species.

Using USFWS protocols, cactus ferruginous pygmy-owl surveys were conducted from February to April 1997 in suitable habitats at the proposed ground support area southwest of Stoval Auxiliary Airfield, in certain areas east or northeast of the Cabeza Prieta Mountains, and in suitable habitat in low-level flight corridors on Cabeza Prieta NWR. During these surveys, pygmy-owls were not detected. However, during subsequent pygmy-owl surveys conducted in the best habitats on the eastern half of Cabeza Prieta NWR in early March 2001, two male pygmy-owls were located near Papago Well on the Cabeza Prieta NWR.

With Revision 1 to this biological opinion, issued 18 March 1998, the proposed action was revised at the request of MCAS Yuma to clarify that Stoval Auxiliary Airfield is used in training operations in support of WTI courses. This revision did not change the conclusions in the biological opinion and did not result in modification of the reasonable and prudent measures or terms and conditions.

On 12 February 2001, the U.S. District Court for the District of Columbia remanded that portion of the biological opinion addressing Sonoran pronghorn (see Defenders of Wildlife, et al. v. Babbitt, et al., Civil Action No. 99-927 ESH [U.S. District Court for the District of Columbia 12

February 2001]). Accordingly, Revision 2 to this biological opinion was issued on 16 November 2001. In addition to addressing Sonoran pronghorn, Revision 2 addresses Peirson's milkvetch, which was listed after the 1996 biological opinion and was not known to occur in the action area until recently.

The 17 April 1996 biological opinion as updated by the 12 March 1998 letter remains the prevailing biological opinion for flat-tailed horned lizard, lesser long-nosed bat, and cactus ferruginous pygmy-owl. However, a 31 July 2001 decision by the Ninth Circuit Court of Appeals ordered the USFWS to reinstate the previously proposed listing rule for the flat-tailed horned lizard. If the flat-tailed horned lizard were listed, further coordination between MCAS Yuma and USFWS with regard to this species would be necessary to determine if further consultation is necessary.

Marine Corps Conservation Measures: With 2-21-95-F-114-R2, many of the 26 conservation measures MCAS Yuma included in the 17 April 1996 biological and conference opinion as part of the proposed action were revisited and updated. Some of these conservation measures are broad-based and apply to all threatened and endangered species, while others are specific to Sonoran pronghorn. They include the following (paraphrased):

- Brief users on federally listed threatened and endangered species and protective measures, responsibilities, regulations, and consequences of violation.
- Contain and dispose of human sewage and litter in a manner that meets all applicable disposal standards. Use temporary containment aprons of plastic and sandbags with vehicles and equipment from which hazardous materials may be spilled or leaked and respond immediately to any spills. In the event of an aircraft crash, determination of appropriate site cleanup and restoration procedures will be coordinated with the responsible agencies within 24 hours.
- Restrict military vehicles to existing roads with three exceptions: (1) when operating in designated ground support areas, the parachute drop zone, or target areas; (2) in case of an emergency; and (3) when there is a bona-fide management need. Clearly mark roads designated for military use and the locations of ground support areas. Limit vehicle use in passes through mountain ranges to the minimum necessary for training and designate a single road for vehicle travel through mountain passes.
- Limit surface disturbance in areas with highly erodible soils when feasible. Where new roadways and ground support areas are established, provide cross- or through-drainages of existing washes. Plan and complete construction and operational activities in a manner that minimizes erosion.
- Limit ground disturbing activities within ACECs to the maximum extent possible consistent with the training mission.
- Manage abandoned Marine Corps ground support areas near El Camino del Diablo Backcountry Byway to promote revegetation by native plant communities.

- Cooperate with Luke AFB in an evaluation of potential adverse effects to pronghorn from ordnance delivery and unexploded ordnance at target sites on the North and South TAC ranges.
- Study the potential effects of chaff on Sonoran pronghorn with an emphasis on the possible toxic conditions of chaff contamination in waters located on the BMGR and Cabeza Prieta NWR.
- Support a fair share of the 51 management and research projects developed by the Sonoran Pronghorn Recovery Team (see Table 4-21).
- Support closure of the Mohawk Valley area of the BMGR to public use from 15 March to 15 July beginning in 2002 to reduce the potential for human disturbance of Sonoran pronghorn during the period that is critical to early fawn survival. Also, support the permanent closure of roads within this area that are not needed for administrative agency use. This includes signing and blocking permanently closed routes with physical barriers by 15 March 2003. Also, construct an interpretive kiosk at the entrance to the BMGR on the road from Tacna describing regulations for public use of the range.
- Provide the USFWS with an annual report regarding the progress made toward implementing the conservation measures, terms and conditions, and reasonable and prudent measures listed in the biological opinion.

Measures from the 17 April 1996 biological and conference opinion specifically designed to protect the flat-tailed horned lizard and its habitat, which were not addressed in 2-21-95-F-114-R2 include the following (paraphrased):

- Implement various protective measures that apply specifically to construction activities at AUX-2 including provisions for biological monitors and minimizing ground disturbance.
- Locate the two westernmost proposed ground support areas in areas of low habitat value for flat-tailed horned lizard. (This item was subsequently negated, however, with the Flat-tailed Horned Lizard Rangewide Management Strategy and establishment of the Flat-tailed Horned Lizard HMA).
- Limit vehicle speeds to 25 miles per hour on paved roads and 15 miles per hour on unpaved roads in flat-tailed horned lizard habitat.
- Develop and implement a range user education program for military users that addresses issues surrounding flat-tailed horned lizards.
- Limit access to the road to AUX-2 to authorized military personnel.
- Support basic research on flat-tailed horned lizards.
- Cooperate with the BLM and USFWS in the development of a management plan for flat-tailed horned lizards (the Flat-tailed Horned Lizard Rangewide Management Strategy).

Anticipated Take—Sonoran pronghorn: With 2-21-95-F-114-R2, the USFWS estimates that no more than six Sonoran pronghorn could be taken as an incidental result of the proposed action. The incidental take is expected to be in the form of harassment (which constitutes more than

mere disturbance of a pronghorn). This incidental take provision will be reviewed concurrent with subsequent five-year reviews of the INRMP.

Anticipated Take—Flat-tailed Horned Lizard: With 2-21-95-F-114, the USFWS estimates take would include 23 flat-tailed horned lizards per year in the form of direct mortality, 10 flat-tailed horned lizards per year in the form of harm resulting from habitat loss or degradation, and an undetermined number of flat-tailed horned lizards in the form of harassment resulting from moving animals out of harm's way. However, the USFWS asserts that with the implementation of the discretionary terms and conditions specific to flat-tailed horned lizard, the anticipated take would be reduced to no more than 10 flat-tailed horned lizards per year from direct mortality, eight per year in the form of harm, and an undeterminable number per year in the form of incidental take from harassment.

USFWS Reasonable and Prudent Measures: With 2-21-95-F-114-R2, the USFWS issued a non-discretionary, binding reasonable and prudent measure for Sonoran pronghorn to "Modify low-level helicopter use to avoid areas of significant pronghorn use to minimize adverse effects from helicopters on the pronghorn and its habitat, particularly areas important for fawns and their mothers." The following non-discretionary terms and conditions implement the reasonable and prudent measure described above and outline any required reporting/monitoring requirements.

- Revise low-level helicopter use in R-2301W, R-2301E, and Cabeza Prieta NWR to avoid fawning sites (see Figures 2-1 and 2-2).
- Between 15 March and 15 July of each year, all helicopters using R-2301W, except those participating in WTI, will remain west of 113 degrees, 53 minutes, or on designated transit routes, or above 1,000 feet AGL.

The reasonable and prudent measures specific to flat-tailed horned lizard from 2-21-95-F-114 were not modified with Revision 2. Due to the listing status of this species, these reasonable and prudent measures and terms and conditions are discretionary. They are as follows (paraphrased):

- Implement a personnel and visitor education/information programs and well-defined operational procedures.
- Locate military activities outside of flat-tailed horned lizard habitat to the extent practicable. Where adverse effects to flat-tailed horned lizards cannot be avoided, the animals shall be moved from harm's way, if possible.
- Monitor incidental take and report findings to the USFWS.

The terms and conditions to implement these reasonable and prudent measures are much the same as the Marine Corps conservation measures associated with the proposed action outlined above.

USFWS Conservation Recommendations: With 2-21-95-F-114-R2, the USFWS recommends that the Marine Corps implement discretionary actions for the benefit of Sonoran pronghorn and Peirson's milkvetch. The USFWS conservation recommendations in 2-21-95-F-114 specific to

flat-tailed horned lizard are much the same as the Marine Corps conservation measures outlined above.

Discretionary USFWS-recommended conservation measures for Sonoran pronghorn include the following (paraphrased):

- Continue to fund and support basic research, inventory, and monitoring of Sonoran pronghorn.
- Fund or staff projects in Sonoran pronghorn recovery actions identified by the Sonoran Pronghorn Recovery Team (14 specific projects are identified) (see Table 4-21).
- Eliminate use of ground support areas 43, 44, 45, and 67 because they are in significant use areas of Sonoran pronghorn, including areas used by fawns and their mothers.
- Coordinate with Luke AFB to implement more intensive monitoring of the North and South TAC ranges.

Discretionary USFWS-recommended conservation measures for Peirson's milkvetch include the following (paraphrased):

- Work with the USFWS, BLM, and other parties to develop and implement a recovery plan for Peirson's milkvetch.
- Fund comprehensive surveys for Peirson's milkvetch in potential habitats during times suitable for plant growth on the BMGR.

Army National Guard: Consultation No. 2-21-92-F-227

The 19 September 1997 biological opinion issued for the Western Army National Guard Aviation Training Site (WAATS) includes an analysis of the effects on the endangered lesser long-nosed bat, American peregrine falcon, and cactus ferruginous pygmy-owl. This biological opinion does not address Sonoran pronghorn and on 12 February 2001 the biological opinion was remanded by the U.S. District Court for the District of Columbia for not doing so (see Defenders of Wildlife, et al. v. Babbitt, et al., Civil Action No. 99-927 ESH [U.S. District Court for the District of Columbia 12 February 2001]). The WAATS expansion project that was the subject of the consultation included (among other things) the establishment of a helicopter aerial gunnery range for use by the Army National Guard in East TAC. The final EIS for this action found that the Army National Guard use of East TAC would not cause existing training to shift to North TAC or South TAC. This was because the Air Force's elimination of F-15E training at the BMGR was correlated with a reduction in air-to-ground training. Therefore, the EIS did not consider impacts to the pronghorn and none were anticipated. The potential effect of the activities proposed that might affect Sonoran pronghorn are limited to those at North TAC, which are minimized by monitoring protocols established by Luke AFB.

In accordance with the court order, this consultation was revised (2-21-92-F-227-R1). In this revision, the Army National Guard committed (subject to funding availability) to assisting with specific recovery actions identified by the Sonoran Pronghorn Recovery Team.

With 2-21-92-F-227-R1, the USFWS concludes that the proposed action is not likely to jeopardize the continued existence of the Sonoran pronghorn. Further, the USFWS does not anticipate any incidental take nor issue any reasonable and prudent measures or terms and conditions. The USFWS issued one discretionary conservation recommendation for the Army National Guard to continue to contribute to funding and supporting basic research, inventory, and monitoring of the pronghorn.

Border Patrol: Consultation No. 2-21-96-F-334

This biological opinion, issued 5 September 2000, addresses all Border Patrol activities along the U.S./Mexico border in Yuma County from the Colorado River to about the area of Pinta Sands at the south end of the Sierra Pinta Mountains. Border Patrol activities within the Yuma Sector/Wellton Station include helicopter and ground patrols, drag road preparation and assessment of road maintenance, remote sensor installation and maintenance, apprehensions and rescues, and assistance to other sectors and agencies. To reduce adverse effects on pronghorn, the Border Patrol agreed to implement the following measures: (1) purchase new, quieter MD600N helicopters to replace existing OH-06As, (2) contact the AGFD weekly for an update on weekend telemetry flights to avoid areas of pronghorn concentration, (3) modify helicopter flights to avoid fawning areas during the three peak months of the fawning season (April to June), (4) make confidential monthly reports to the manager of Cabeza Prieta NWR detailing the law enforcement actions and wildlife observations made during the previous month, (5) finalize the Memorandum of Understanding between the Border Patrol and Cabeza Prieta NWR to address objectives that will minimize potential conflicts including limiting routine patrols and off-road use in wilderness and providing a framework for cooperation, and (6) conduct an annual interagency meeting to present the annual report and discuss ways to improve coordination.

The USFWS determined that the proposed action would not be likely to jeopardize the continued existence of Sonoran pronghorn. The USFWS anticipates take in the form of harassment that is likely to injure up to one pronghorn in 10 years.

The following reasonable and prudent measures are provided: (1) minimize injury of pronghorn, (2) monitor and study reactions of pronghorn on the BMGR to Border Patrol activities, and (3) provide a means to determine the level of incidental take that results from Border Patrol activities. The biological opinion also issues various mandatory terms and conditions to implement these reasonable and prudent measures. The following conservation recommendations are provided: (1) assign an environmental protection specialist to coordinate the effects of Border Patrol activities statewide on listed species in order to reduce these impacts where possible, (2)

continue participation in ecosystem partnerships with other federal agencies in pronghorn habitat, and (3) obliterate and block illegal roads in pronghorn habitat created by illegal border traffic.

BLM: Consultation No. 2-21-85-90-F-042

This biological opinion, issued 25 April 1990 for the 1990 Lower Gila South Resource Management Plan Goldwater Amendment is programmatic. It concludes that the proposed action is not likely to jeopardize the continued existence of Sonoran pronghorn, lesser long-nosed bat, or Tumamoc globeberry (a species that has since been delisted). It requires BLM to consult when site-specific projects are proposed. To date, no site-specific formal consultations have been conducted. General conservation recommendations include closing recreation roads in Sonoran pronghorn habitat, precluding wild horse and burro populations from Sonoran pronghorn habitat, studying the benefits and adverse effect of manmade and maintained water sources on Sonoran pronghorn, installing gates that allow for the passage of bats when sealing mines/caves, and closing caves/mines that are used by the lesser long-nosed bat to the public.

Other Informal BLM Consultations

Additional informal programmatic-level consultation for the Lechuguilla-Mohawk HMP resulted in concurrence from the USFWS that the activity plan was not likely to adversely affect the Sonoran pronghorn (Consultation No. 2-21-96-I-278). Informal programmatic-level consultation was also initiated for the Draft Barry M. Goldwater East HMP, resulting in a “may affect, not likely to adversely effect” finding for the Sonoran pronghorn, lesser long-nosed bat, and cactus ferruginous pygmy owl with certain conditions (Consultation No. 2-21-99-I-160). However, this plan was never finalized. Similarly, there was also an informal consultation for the Gila Bend to Ajo 230 kV Transmission Line Project, which resulted in a concurrence that the proposed project may affect, but is not likely to affect the Sonoran pronghorn, lesser long-nosed bat, and cactus ferruginous pygmy owl (Consultation No. 2-21-97-I-055). This project has been on hold for some time and may or may not be reinitiated. (Also see Table 4-22).

4.7.3.3 Protected Species Programs

Sonoran Pronghorn Recovery Team

The Air Force and Marine Corps are members of the Sonoran Pronghorn Recovery Team, which was first formed in 1975 in order to develop the 1982 Recovery Plan for the Sonoran Pronghorn. The recovery team was led by the AGFD and its members included the Cabeza Prieta NWR, BLM, and Organ Pipe Cactus NM. This recovery team was disbanded in 1988 after the Regional

Director of the Southwest Region of the USFWS approved the plan and Cabeza Prieta NWR was designated as the lead office for recovery efforts. The USFWS is the ultimate authority in overseeing recovery efforts through provisions of the ESA, including Section 7 consultation requirements. In May 1991, the Sonoran Pronghorn Core Working Group (now the Recovery Team) was formed to advise the Refuge Manager of Cabeza Prieta NWR and the USFWS Regional Director regarding recovery efforts for the endangered Sonoran pronghorn. The Recovery Team is comprised of one or more representatives from each agency that has a mandate to protect the subspecies and/or that manages land where Sonoran pronghorn inhabit or have inhabited in the past. It also includes partnerships with Mexico and the Tohono O'odham Nation as well as ongoing coordination with representatives from USFWS Ecological Services. The following are current members of the Recovery Team:

- AGFD
- Cabeza Prieta NWR
- BLM Yuma and Phoenix Field Offices
- Luke AFB
- MCAS Yuma
- Organ Pipe Cactus NM
- El Pinacate Biosphere Reserve
- University of Arizona
- Instituto del Medio Ambiente y el Desarrollo Sustentable de Estatio de Sonora (IMADES)
- Army National Guard

This Recovery Team collaborated to prepare the 1998 Final Revised Sonoran Pronghorn Recovery Plan (USFWS 1998a) and continues to work on various Sonoran pronghorn research and management activities.

Sonoran Pronghorn Recovery Plan

The primary objective of the 1998 USFWS Sonoran Pronghorn Recovery Plan is downlisting of the endangered Sonoran pronghorn. Actions called for in the plan include:

- enhance present populations by providing supplemental forage and/or water
- determine habitat needs and protect the present range
- investigate and address potential barriers to expansion of presently used range
- establish a protocol for repeatable and comparable survey techniques and continue monitoring populations
- investigate the use of satellite telemetry to determine unknown factors of life history
- investigate, evaluate, and prioritize present and future actions of re-introduction sites within historic range relative to a potential captive breeding program and/or transplant program

- establish and monitor a new separate herd to guard against catastrophes decimating the core population
- examine additional specimen evidence available presently to assist in verification of taxonomic status
- investigate relevant physiological characteristics to verify taxonomic status

The USFWS prepared a supplement and amendment to the 1998 Recovery Plan in 2002 to address those sections that were remanded to the USFWS as a result of the U.S. District Court Order. The 2002 supplement does not change the actions called for in the 1998 plan, but includes objective criteria for measuring progress and provides estimates of the time needed to carry out the measures (USFWS 2002b).

Sonoran Pronghorn Forage Enhancement

The Sonoran Pronghorn Recovery Team proposed a project to grow native annual and perennial forage for Sonoran pronghorn in 10 areas on the BMGR beginning in the fall of 2001; the Air Force, Marine Corps, and AGFD are now implementing the project. This project, currently led by the Air Force, stems from formal consultation with the USFWS that produced a biological opinion for the Sonoran pronghorn (biological opinion 2-21-96-F-094, dated 27 August 1997 as supported by revision R1, dated 16 November 2001). The forage enhancement project is also one of the measures identified by the 1998 Revised Sonoran Pronghorn Recovery Plan.

According to the EA and Finding of No Significant Impact (FONSI) prepared by the U.S. Air Force (2000 and 2001a), a total of 1,983 acres may be affected by the project in 10 food plots located on the BMGR. The 10 plots were selected after review of radio telemetry data to determine areas that were repeatedly used during the past five years by Sonoran pronghorn. The plots would be located along existing roadways and in areas of sandy soils, which are more conducive to forage growth and persistence. Eight of the 10 plots would be one square kilometer (247 acres) in size each. Two of the 10 plots would parallel existing roads and encompass about 0.015 square kilometers each (500 by 30 meters or 3.7 acres).

Within each plot, a combination of the following habitat manipulation strategies would occur based on the characteristics of the site and logistics:

- Creosotebush would be thinned to reduce competition for water and allow more area to be used for forb production. Thinning would be accomplished by selectively burning individual plants using a hand-carried propane torch.
- Three irrigation wells would be installed within the areas surveyed for the plots, with one well being used to serve two or three plots. The hardware at each site would include the wellhead; a water storage tank; and associated piping, power sources, and equipment to be stored on site between irrigation episodes. The exception is three food plots near the Aztec Hills, where water would be hauled in.

- An aboveground water sprinkler system would be used to irrigate the plots as needed to propagate and keep the forbs alive while Sonoran pronghorn are in the area or until summer rains relieve the need for watering. The irrigated area would be about 7,500 square meters (1.85 acres) per plot.
- If there are areas within the plots where natural germination does not occur following the irrigation, seed collected by hand from the BMGR could be planted within the plots. Raking would be used to prepare a seed bed.
- A temporary supply of free-standing water would be created at the food plots via underground piping during periods when they are being used by Sonoran pronghorn.
- Primitive camping/staging areas would be necessary for use by field crews during project activities. Previously disturbed sites would be used when possible.
- The project would continue for seven years and periodically be monitored for results and success.

Two wells were dug in 2002, but only one of these resulted in a viable water supply. The successful well is at the Granite Site in San Cristobal Valley where food plot development is underway. Development has also begun at the second site, the Mohawk Site in the Mohawk Valley, which was moved about five miles west of the location analyzed in the EA after detailed geophysical analysis found that water would be more likely at this location and Sonoran pronghorn locations are slightly more prevalent in this area. Although not specifically evaluated in the EA, two additional sites near Daniel's Arroyo have also been approved for implementation under separate categorical exclusions (one for the Air Force and one for the USFWS) since much of the analysis conducted in the EA was valid for these new sites. One site is south of Charlie Bell Road within the non-Wilderness portion of Cabeza Prieta NWR. At this location, a well would be drilled to provide water for a food plot. At the other location, on BMGR—East between the refuge boundary and RMCP 1, an existing water source would be used for the development of a food plot (Morgart 2002b and 2002c).

At one of the latter two locations, planning is underway by the Sonoran Pronghorn Recovery Team to implement a semi-captive breeding experiment as an emergency measure due to the recent decline in Sonoran pronghorn population estimates. An approximately one-square-kilometer fenced perimeter would be constructed surrounding the food plot, but only three sides will initially be closed. If Sonoran pronghorn are attracted to the site, an attempt would be made to enclose the fourth side of the fence to capture a portion of the remaining Sonoran pronghorn population within the enclosure. An electric fence would be erected to the exterior of the Sonoran pronghorn enclosure to keep predators at bay (Morgart 2002b and 2002c).

Biological (Sonoran Pronghorn) Monitoring in Association with the Tactical Ranges

Among the actions that the Air Force has taken to evaluate and minimize potential impacts of Air Force activities on Sonoran pronghorn, periodic monitoring for the subspecies is conducted at

North TAC and South TAC with limited monitoring at Manned Range 1 (i.e., the day following a Sonoran pronghorn sighting at Manned Range 1). Monitoring includes visual observations with the aid of binoculars and spotting scopes as well as telemetry surveillance to locate collared Sonoran pronghorn. Biologists survey the ranges from hilltops or other vantage points before the first scheduled mission of the day to determine if Sonoran pronghorn are in the area. North and South TAC monitoring is conducted prior to live ordnance missions, every Monday, the day after a Sonoran pronghorn is located on a range, prior to live-Maverick missile missions, and prior to EOD detonations.

The Air Force has erected towers near the HE hills in North and South TAC for monitoring purposes. If any ordnance is dropped on non-approved areas or closed targets, monitors survey the site within 24 hours and conduct a systematic search of the area for evidence of pronghorn mortality. In addition, Childs Valley on the Cabeza Prieta NWR, adjacent to Manned Range 1, is monitored weekly to track collared Sonoran pronghorn near the tactical ranges.

If a Sonoran pronghorn is located within a 5 km radius (i.e., safety zone) of HE hill, no high explosive ordnance deliveries are authorized on the affected tactical range and the mission is diverted or cancelled. In addition, no ordnance deliveries of any kind (i.e., inert ordnance) are authorized within 3 km radius of any pronghorn location for the remainder of the day. The maximum time allowed between live ordnance delivery missions is two hours. If subsequent missions are scheduled to occur after a two-hour time period, another Sonoran pronghorn survey and clearance is required.

As a result of Sonoran pronghorn observations on the tactical ranges:

- 58 sorties were cancelled and 65 were moved in 1998
- six sorties were cancelled and 139 were moved in 1999
- 32 sorties were cancelled and 177 were moved in 2000
- 7 sorties were cancelled and 158 sorties moved in 2001
- HE hills were closed 45 percent of the regular operating time in 2000 and 32 percent of the regular operating time in 2001
- one or more inert targets are closed 85 percent of the regular operating time (Garcia 2001 and U.S. Air Force, Luke AFB 2002a).

When Sonoran pronghorn are located, basic biological information is collected and reported to 56th RMO. The data collected include location of sighting, coordinates, activity when sighted, number and composition of herd, number of fawns, and last known direction of travel. Strict compliance with the biological opinion is adhered to in all aspects of the monitoring activities. Protocols for standardizing the biological monitoring are described in *Luke AFB Operating Instruction 1-1, Sonoran Pronghorn Monitoring*. Additionally, monitors work together and with other range personnel to ensure all personnel are aware of Sonoran pronghorn locations in an effort to minimize disturbance (USFWS 2001a).

Rescheduling of South TAC Annual EOD Clean-up

Tactical ranges are used year-round except for scheduled range maintenance periods. Each tactical range is closed for a period of approximately eight weeks each year for range maintenance and EOD clearance. In studying the long-term noise effects of military overflights on Sonoran pronghorn behavior, Krausman and others (2001) found that with the range clearance ground activity the Sonoran pronghorn are startled and are likely to trot or run for brief spurts, which may negatively affect the animal's water balance in the hot, dry summer months. To prevent or minimize this response during the summer heat, the EOD tactical range maintenance schedule was recently changed to further reduce potential effects to Sonoran pronghorn and is now as follows: East TAC (15 March – 15 May), North TAC (1 January – 28 February), and South TAC (1 October - 15 December) (USFWS 2001a).

Bat Surveys and Management Activities

The Air Force has supported several bat surveys/studies and management activities. This has included the purchasing of equipment used to study lesser long-nosed bat roost sites in Cabeza Prieta NWR and Organ Pipe Cactus NM, studies to assess the impacts of military overflights on a lesser long-nosed bat maternity colony at Organ Pipe Cactus NM (Dalton and Dalton 1993), and a survey of abandoned mines and a radio telemetry investigation of lesser long-nosed bat movements and foraging patterns on the Cabeza Prieta NWR (Howell 1994).

A systematic survey of all known mines on the eastern and western sections of the BMGR was initiated in 1992 (Dalton and Dalton 1994). Of the 101 sites visited, 11 sites were found to contain bats and an additional 10 sites were considered important to bats. A follow-up study of the mines in which bats were detected in 1992 was completed in 1997 (Dames & Moore 1997a). Twenty-nine sites were visited during the summer reproductive season (May to July) and winter (November to February). Bats were found in 16 of the 19 sites identified by Dalton and Dalton (1994) and in several additional sites not previously examined.

Most recently surveys have been conducted in the BMGR portion of the Sand Tank and Sauceda mountains to locate and study bat roosts and to determine the home range, major roosting sites, habitat use, and foraging requirements of California leaf-nosed bats. Over the past several years, new roosts and potential roost sites for California leaf-nosed bats have been discovered by Dalton and Dalton (1994, 1999), Dalton and others (2000), and Dalton (2001).

In addition to these surveys, the military and BLM have coordinated on the installation of bat-friendly gates at the entrances to some mines and caves on the BMGR to protect roosting sites from BMGR recreational users.

Some bat species that occur on the BMGR, which are not federally protected or listed in Wildlife of Special Concern in Arizona (AGFD 1996 in preparation), are managed in accordance with the *Arizona Bat Species Priority Matrix*. This matrix is intended to provide management agencies and interested organizations and individuals with a means to prioritize conservation actions given limited funding and resources currently devoted to bats. Species ranking of high priority correlates with federal or state listing. Species ranked as medium priority indicate a level of concern, but information regarding the species and perceived threats is lacking. Species ranked as low priority indicate that most of the existing data suggest populations are stable, and the potential for major changes in status are unlikely.

Flat-tailed Horned Lizard Rangewide Management Strategy

This management strategy was developed by an interagency coordinating committee of federal, state, and local representatives to provide guidance for the conservation and management of sufficient habitat to maintain viable populations of flat-tailed horned lizards (Foreman 1997). The Rangewide Management Strategy calls for the establishment of five flat-tailed horned lizard management areas—four in California and one in Arizona. The management area in Arizona includes part of BMGR—West and lands west of the BMGR. The Arizona management area has been active since 1997. In these areas, vehicle use is limited to designated roads and trails using only street-legal vehicles. To the extent possible, MCAS Yuma locates activities outside of flat-tailed horned lizard habitat. MCAS Yuma entered into a conservation agreement with the AGFD and USFWS to develop and implement the flat-tailed horned lizard management strategy, which led to the withdrawal of the proposed listing of the species. Creation of a sixth management area in the Coachella Valley has been proposed and is currently under study (Pearce 2001a).

Cactus Ferruginous Pygmy-Owl Surveys

Although no cactus ferruginous pygmy-owls have been detected on the BMGR to date, the 56th RMO continues monitoring of established transects using USFWS methodology to determine if cactus ferruginous pygmy-owls colonize the range.

Management of the Desert Tortoise (Sonoran Population)

Ongoing long-term monitoring efforts are aimed at determining and comparing the status of desert tortoise (Sonoran populations) within and outside the boundaries of the tactical ranges in order to assess any impacts that military operations may have on tortoise populations (Wirt 1994). From a scientific research perspective, the BMGR is a prime location for long-term study of the Sonoran population of desert tortoises because of the lack of previous human disturbance throughout most of the area and because of strict control of access to the site.

The BLM Desert Tortoise Management on the Public Lands: a Rangewide Plan (Sprang and others 1988) guides the BLM in its management of desert tortoise habitat. The goal is to manage habitat so as to ensure that viable desert tortoise populations exist on public lands to be accomplished through cooperative resource management aimed at protecting the species and its habitat. Tortoise habitat is categorized according to four criteria: (1) importance of the habitat to maintaining viable populations, (2) resolvability of conflicts, (3) tortoise density, and (4) population status (i.e., stable, increasing, decreasing). Differing levels of management, consistent with category goals, are applied to areas of tortoise habitat.

Within the BMGR, the mountain ranges are in Category 3 (i.e., areas with low to medium tortoise density not contiguous with medium or high density). The terraces and valleys between mountain ranges are generally not considered habitat for the tortoise. The placing of an area of habitat in Category 3 means that these areas are of lower value in sustaining viable populations of tortoises on the public lands, and thus can be subjected to lower management intensity specifically for tortoises. The category goal for Category 3 habitat areas is to limit tortoise habitat and population declines to the extent possible by mitigating impacts. Specific actions called for that might apply to the BMGR include (1) complete and maintain an inventory and monitoring program, (2) develop and maintain a monitoring program specifically for land-use activities that adversely affect tortoise habitat to enable analysis of and response to cumulative impacts, and (3) develop and maintain effective coordination and cooperation with other agencies. This document is potentially useful in that it defines the level of management for tortoises on the BMGR, which is a very low level of management concern.

Migratory Bird Programs

The Air Force is a cooperating agency in Arizona Partners in Flight and Luke AFB has participated in this program in various ways, including contributing to Arizona Breeding Bird Atlas through the establishment and ongoing survey of breeding birds within BMGR—East.

In addition, the Air Force funded a study on the importance of desert ecosystems to neotropical migratory birds during migration and how neotropical migratory birds may be affected by Air Force activities. Three years of baseline data were collected (1994-96) in the Sauceda Mountains on three transects with 10 count stations on each transect (Morrison and others 1997). During this initial phase, 110 species of birds were recorded of which 71 percent were breeding or passage neotropical migrants. Neotropical migrants were generally more restricted in habitat requirements than resident species and showed a strong association with overstory mesquite and paloverde. Three additional transects were established and monitoring of the six transects on a bi-annual basis began in 1998 and continues to document long-term population fluctuations (Bibles and Harris 1999).

4.7.4 Information Not Currently Available to Support Protected Species Management

The current lack of some existing data or information poses potential challenges for the future management of protected species within the BMGR. This currently unavailable information was identified during the preparation of the affected environment section of this EIS. It does not constitute incomplete or unavailable information needed to conduct the environmental impact analysis presented in Chapter 5 in accordance with 40 CFR §1502.22. Although additional protected species information needs may be defined in the future, those identified in this document include:

- *Peirson's Milkvetch.* The potential occurrence and distribution of the Peirson's milkvetch in BMGR—West has not been systematically determined.

- *Protected Bird Species.* Several protected species of birds are not expected to occur on the BMGR (Yuma clapper rail, Southwestern willow flycatcher, bald eagle, mountain plover, ferruginous hawk, snowy egret, Peregrine falcon, Crested caracara, tropical kingbird, Belted kingfisher, and Sprague's pipit), but a definitive determination of the absence of these species has not been established.

- *Migratory Birds.* The potential for the unintentional take of migratory birds reasonably attributable to military or non-military activities on the BMGR has not been determined.

- *Yuma Puma.* The taxonomic validity of the Yuma puma as a subspecies is currently unresolved, although additional taxonomy efforts are being conducted by the AGFD (Best and Gay in press).

- *Bat Roost Sites.* Further evaluation of fully effective means of protecting bat cave/mine roost sites from unauthorized access but that do not impede colonization by bats is needed at all applicable roost sites.

- *Flat-Tailed Horned Lizard*. Hall and others (2001) report that existing data are not complete for either (1) the current population density and abundance of the flat-tailed horned lizard on the BMGR or (2) evidence of the long-term effects of invasive plants or UDA-related off-road traffic on this population.

- *Desert Tortoise (Sonoran Population)*. Hall and others (2001) report that existing data are incomplete regarding the effects of climate change on the rates of desert tortoise mortality and recruitment, the relative importance of lower bajadas (caliche caves) for tortoise habitat and dispersal, the effects of military and recreational activities in lower bajadas on tortoise populations, or patterns of tortoise population change and viability throughout the BMGR.

- *California Leaf-Nosed Bat.* Dalton and others (2000) and Dalton (2001) report that existing data do not identify use areas and day roost sites for the California leaf-nosed bat in the vicinity of East TAC. Some California leaf-nosed bats have been observed utilizing active training areas in East TAC, but the importance of this area to the bat is not understood (Dalton and others 2000). Two California leaf-nosed bat roost sites are located within two miles of a live ordnance target in East TAC (Dalton and Dalton 1999). The potential effects of increased nighttime military training missions in East TAC on foraging by this colony cannot be reliably assessed with existing data (Dalton 2001).

- *Sonoran Pronghorn Recovery.* The effectiveness of the forage enhancement plots and planned semi-captive breeding actions in the recovery of Sonoran pronghorn cannot be determined until the study is implemented and data to assess effectiveness are available. (See Table 4-21 for Sonoran pronghorn recovery actions.)

- *Sonoran Pronghorn Taxonomy.* The taxonomic status of the Sonoran pronghorn as a separate subspecies has been questioned, but not enough data are available to clearly resolve the debate.

- *Saguaro Cacti Recruitment.* The extent to which EOD activities may have/will affect recruitment of saguaro cacti in the one-year and five-year sweep areas of East TAC is not specifically known. Also unknown are the potential long-term effects, if any, on lesser long-nosed bat that would result if EOD activities are notably impacting saguaro recruitment.

4.8 WILDFIRE MANAGEMENT

4.8.1 Existing Conditions

4.8.1.1 Ecoregional Context

Humphrey (1963) identifies the generally limited role of fire in shaping the plant communities of the Sonoran Desert, limiting the occurrence of fire mostly to tobosa grass (*Pleuraphis mutica)* swales. Under natural conditions in the Sonoran Desert, fires typically should be infrequent, weak in intensity, and small in the area that they affect. This is supported by Schmid and Rogers (1988), who calculated a fire recurrence interval of 294 years for the Sonoran Desert portion of the Tonto National Forest in Arizona during a 29-year study period (1955 to 1983). They also report an increase in fire occurrence when comparing the recurrence intervals from the second half of the study period with the first half). Whereas during the first half of the 29-year study period the recurrence interval was calculated as 340 years, the recurrence interval in the second half of the study was calculated at 226 years (an increase of 114 years). They attributed this

increase to wetter-than-normal winters that enhanced vegetative growth toward the end of the study period, fuel provided by the presence of non-native annual plants, improved fire detection and reporting, and fire ignition by people.

Many in the scientific community are concerned that the introduction of non-native, perennial grass species of African origin may alter natural fire frequency and intensity in the Sonoran Desert. These grasses, such as buffelgrass (*Cenchrus ciliaris*), fountain grass (*Pennisetum alopecuroides*), Lehmann lovegrass (*Eragrostis lehmanniana*), and Johnson grass (*Sorghum halepense*), have the potential to affect ecosystem function by: (1) increasing the frequency and intensity of fire; (2) altering productivity or trophic structure; (3) altering microclimate and shifting the rates of consumption and supply of light, water, and mineral nutrients; (4) altering competitive interactions; and (5) compromising ecosystem stability (Williams and Baruch 2000). Fire cycles in buffelgrass allow the grass to expand rapidly into large areas of cleared vegetation and recurrent fires maintain the buffelgrass (Phillips and Comus 2000). Fire under these circumstances potentially can be an extremely powerful and disruptive force that alters the natural composition, structure, and function of natural communities.

Because these non-native grasses spread rapidly once fire has cleared out other vegetation, areas with native vegetation may be converted to African grass-dominated areas. Therefore, an alteration of the natural fire regime may result in an invasion-induced ecosystem-level change (D'Antonio and Vitousek 1992). As a result, these grasses do not simply compete with native species; they alter environmental conditions or resource availability (D'Antonio and Vitousek 1992). Although some Sonoran Desert native plant species show adaptations to fire, either they are not strongly developed (Rogers and Steele 1980) or, more typically, they are limited to species that are not restricted in their distribution to the Sonoran Desert (McAuliffe 1997). Many of the characteristic cacti, woody legumes, and shrubs of the Sonoran Desert are fire intolerant (McAuliffe 1997, Nabhan and Holdsworth 1999).

4.8.1.2 Fire Potential on the BMGR

In general, plant cover on the range is too sparse to carry wildfire effectively or to generate fires with sufficient heat to be self-propagating. Wildfires on the range, whether of human or natural causes, are relatively rare and typically do not exceed one or two acres before burning out naturally. The fire potential on the BMGR is rated by the BLM as extremely low and resource damage that can be caused by fire is regarded as minimal (U.S. DOI, BLM 1990a). The USFWS reached the same conclusion about the Cabeza Prieta NWR (USFWS 1985).

Wildfire has the potential to affect some plant communities on the range, at least locally. Above average winter precipitation can generate a sufficiently dense growth of grasses and other annual plants to potentially carry wildfire over a more widespread area than is typical. This effect is most likely in the upland and mountainous areas of the far eastern range where high annual plant

densities and steep slopes may combine to create conditions to carry fire. The upslope effects of wind and convection are often factors in propagating fires in these circumstances. The largest fire recorded in the BMGR vicinity, and the only one known to be actively suppressed in at least the last 12 years, occurred under such conditions in the Sand Tank Mountains during the summer of 1994. The fire was recorded in the portion of the Sand Tank Mountains that was formerly part of the BMGR land withdrawal, but was not included in the withdrawal authorized by the MLWA of 1999. The BLM used ground crews and aerial tankers to suppress this fire, which reached 200 to 300 acres in size. Lightning is thought to be the cause of this fire (Dahlem 1998). In May 1979, Organ Pipe Cactus NM had a lightning strike fire that burned approximately 30 acres before being extinguished with hand tools, although the fire would probably have burned itself out without covering appreciably more acreage.

Potential causes of fire on the BMGR include lightning strikes, munitions delivery, aircraft crashes, and parachute-equipped target illumination flares that fail to burn out entirely before reaching the ground. Human activities, such as the careless disposal of smoking materials or poor campfire management, may also start wildfires but have not been identified as a problem on the range. Fires caused by military munitions use have been recorded in the target ranges of the BMGR. Generally, these fires have not exceeded one or two acres, although larger areas have burned in a few locations. The density of vegetation in the lower elevation valley areas where target ranges are located has not been sufficient to carry fire and no fire suppression efforts have been necessary.

TNC notes that the Creosotebush-Big Galleta Scrub and Valley Bottom Floodplain Complex natural communities are particularly vulnerable to damage from fire. If the Creosotebush-Big Galleta Scrub community burned historically it is likely that the role of fire was minimal; however, the presence of invasive plant species capable of sustaining fire may increase the frequency and extent of fires. The Valley Bottom Floodplain Complex community is not fire adapted and any occurrence of fire generally would kill much of the native species present. TNC also notes that the eastern part of the BMGR is most vulnerable to fire carried by red brome and may in general have higher fuel loads generated by the presence of invasives due to its higher rainfall and greater proximity to vector sources for invasives compared to the western portion of the BMGR (Hall and others 2001).

4.8.2 Interrelationship Between the Military Mission and Wildfire Management

Potential manmade causes of fire on the BMGR include military sources such as munitions delivery, aircraft crashes, and parachute-equipped target illumination flares that fail to burn out entirely before reaching the ground. Some ground-based military activities, such as bivouac exercises, may involve the use of controlled campfires. Other ground-based activities such as equipment use and munitions detonations during range maintenance, and EOD cleanup could also cause fire. Fires caused by military munitions use have been recorded in the target ranges of

the BMGR; these fires typically burn only a small area. The density of vegetation in the lower elevation valley areas where target ranges are located has not been sufficient to carry fire and no fire suppression efforts have been necessary (U.S. Air Force 1999).

4.8.3 Existing Regulatory and Statutory Requirements and Management Plans and Actions

4.8.3.1 Regulatory and Statutory Requirements

- **MLWA of 1999** states that the INMRP shall provide that the Secretary of the Navy and the Secretary of the Air Force:
    1. shall take necessary actions to prevent, suppress, and manage brush and range fires occurring within the boundaries of the BMGR, as well as brush and range fires occurring outside the boundaries of the BMGR resulting from military activities; and
    2. may obligate funds appropriated or otherwise available to the Secretaries to enter into memoranda of understanding, and cooperative agreements that shall reimburse the Secretary of the Interior for costs incurred (Sec. 3031(b)(3)(E)(vi))

- **10 U.S.C. 2465**, with certain exceptions, forbids DoD from hiring outside contractors for the performance of firefighting functions at any military installation or facility when existing federal services are available. The General Accounting Office does not allow DoD to reimburse BLM fire fighters for activities in support of DoD where BLM is already budgeted (Karls 2000).

4.8.3.2 Management Plans and Actions

The Goldwater Amendment and Memorandum of Understanding between the BLM Phoenix Field Office and U.S. Air Force, Luke AFB (1990) for its implementation specify that the BLM shall suppress wildfires resulting from non-military uses of the BMGR and provide assistance in the suppression of fires resulting from the military use on the BMGR when requested by the U.S. Air Force. The subject Memorandum of Understanding also states that the U.S. Air Force shall transfer funds, as appropriate, to the BLM as compensation for such assistance.

The BLM currently has a fire plan in effect for the Lower Gila South RMP area, which includes the BMGR and surrounding lands. Full and immediate suppression of wild fire is called for in riparian areas and desert washes where wildlife values are high and fire is highly detrimental. Throughout the Lower Gila South RMP area, fire is extremely rare and self-limiting due to lack of fuel.

On the BMGR, few fires other than those caused by military activities have occurred in the last 20 years and those have been small and non-spreading (U.S. Air Force 1999). In 1995, the Sand Tank Fire, just north of Javelina Mountain (which was part of the BMGR at that time) burned approximately 140 acres and was caused by lightning (Dahlem 2002a).

The BLM in Arizona is responsible for fire management on 14.2 million acres of public lands. Professional fire management staff provides wildland firefighting capabilities for resource protection as well as fire use to improve the health of the land. The Arizona fire management program is divided into four BLM fire zones, and the BMGR is in the Phoenix/Kingman fire zone. Each of these fire zones have dispatch offices that provide initial attack and extended attack dispatching. When a fire exceeds capabilities, the dispatch offices request additional fire resources (U.S. DOI, BLM 2001a).

Following the unprecedented number of wildfires that struck the western United States in the summer of 2000, the President asked that a national strategy be developed to prevent the loss of property and livelihoods in the wildland-urban interface, which is that area where rural meets urban. Working with Congress, the Secretaries of the Departments of Agriculture and the Interior jointly developed the National Fire Plan to respond to severe wildland fires, reduce their impacts on rural communities, and assure sufficient firefighting capabilities for the future.

The National Fire Plan includes five key points: firefighting preparedness, rehabilitation and restoration of burned areas, reduction of hazardous fuels, community assistance, and accountability. Based on the National Fire Plan, DOI and the Department of Agriculture, U.S. Forest Service will implement a number of program actions to reduce hazardous fuels and their adverse effects on forest and range lands, mitigate the impacts of severe wildfires on rural communities, and enhance firefighting capabilities. In Arizona, those actions will include hiring additional personnel, purchasing additional equipment and facilities; co-sponsoring research projects; conducting long-term rehabilitation and emergency stabilization on burned wildlands; treating fuels in wildland-urban interface areas; maintaining/restoring range or forest health; and assisting rural volunteer fire departments nationwide with training, equipment, and supplies to increase their level of preparedness for wildland firefighting (U.S. Department of Agriculture, Forest Service and others 2001).

4.8.4 Information Not Currently Available to Support Wildfire Management

The current lack of some data or information that poses a potential challenge for future wildfire management within the BMGR concerns the extent to which the spread of invasive plants within the BMGR may increase the risk of wildfires that are harmful to native plant communities. Some invasive plant populations can provide a fuel base that will carry a wildfire that would otherwise not propagate within the native plant community. Existing data do not quantify the full extent to which invasive plants may be colonizing the BMGR or the degree to which these invasive plant

populations are increasing wildfire hazards. This currently unavailable information was identified during the preparation of the affected environment section of this EIS. It does not constitute incomplete or unavailable information needed to conduct the environmental impact analysis presented in Chapter 5 in accordance with 40 CFR §1502.22.

4.9 GROUNDS MAINTENANCE

4.9.1 Existing Conditions

Although the BMGR comprises a vast area of land, developed and semi-developed grounds only total about 385 acres, and much less is actually treated with pest management agents such as pesticides and herbicides. Pesticides are only used at BMGR facilities, or on improved and semi-improved grounds, and are not to be used in unimproved, desert, or environmentally sensitive areas, unless required for operational necessity or the protection of personnel (USAF 2001).

At the few developed sites on the range, such as the Gila Bend AFAF and Cannon Air Defense Complex, landscaped vegetation has been used primarily to improve the aesthetics of these areas that, in comparison to the rest of the BMGR, have been vastly modified from their natural state. The nature of the military mission accomplished at these sites is different from most of the BMGR. Rather than serving as military training locations, these areas are key administrative and support facilities where personnel are regularly assigned as they would be to any other administrative or support base or work site.

4.9.1.1 Gila Bend Air Force Auxiliary Field

At one time, personnel assigned to Gila Bend AFAF were also housed in living quarters at the complex. However, with a few exceptions, this is no longer the case as many of the administrative and support functions have been contracted out to the private sector. Some quarters at the AFAF are used by those working at the BMGR on a temporary basis and by retirees that are passing through the area. Landscaping improves the aesthetics and visual environment for the personnel assigned to and/or visiting these locations.

The disturbed areas at Gila Bend AFAF are characterized by a lack of vegetation or are dominated by weedy species such as burro bush. Some disturbed areas retain creosotebush/bursage vegetation, but the density and species diversity is greatly reduced relative to the surrounding undisturbed areas. Severely disturbed areas (e.g., paved areas, areas of bare ground or burro bush) will not likely return to predisturbance conditions.

Creosotebush and white bursage comprise about 90 percent of the vegetative cover in all but the most alkaline soils, with paloverde (*Cercidium floridum*) found near moister areas around

washes. Associated vegetation includes numerous grasses and forbs and several species of cacti. Bermuda grass has proven the most satisfactory lawn cover for most applications.

Existing landscape vegetation at Gila Bend AFAF includes desert willow, Russian olive, bottlebrush, eucalyptus, mulberry, Aleppo pine, oleander, century plants, ocotillo, saguaro, various other cacti, and palm trees. These desert-adapted plants do not require extensive care to survive (USAF 1995).

The 2001 *Pest Management Plan for Gila Bend Air Force Auxiliary Field and the Barry M. Goldwater Range* describes Gila Bend AFAF pest management operations, including both herbicide and pesticide application. Per the plan, these operations are "based on [Integrated Pest Management], which is a comprehensive approach to pest control or prevention which considers various chemical, physical, and biological suppression techniques, the pest's habitat, and the interrelationship between the pest populations and the ecosystem."

The Air Force does not permit the use of restricted pesticides at the BMGR, including Gila Bend AFAF in its grounds maintenance operations. In addition, no grounds maintenance activities are allowed that would result in a potential for groundwater or surface water contamination. Although herbicide products such as Roundup and Surflan are used for weed control at Gila Bend AFAF, these products contain ingredients that are formulated to bond with the soil. The only surface water in the area of Gila Bend AFAF is the wastewater lagoon and pesticides are not applied at the active lagoon (USAF 2001).

Details regarding the pest management program operations, program management, facilities (security and storage protocol), health and safety programs, and applicable regulatory compliance are also included in the pest management plan.

4.9.1.2 Cannon Air Defense Complex

For grounds maintenance issues at Cannon Air Defense Complex, the Marine Corps maintains an integrated pest management plan with guidelines that are comparable to those described for the Gila Bend AFAF. The plan serves as a reference for the type and amount of pesticides and/or herbicides used at the complex, as well as safe application and storage practices. As with Gila Bend AFAF, restricted pesticides are not used at the complex because their use is prohibited from the entire BMGR (Pearce 2002a).

4.9.2 Interrelationship Between the Military Mission and Grounds Maintenance

In general, maintaining an orderly appearance at locations such as Gila Bend AFAF and the Cannon Air Defense Complex on the BMGR is conducive to the military mission. Weed

management reduces the potential for fuel in the event of wildfires. Grounds maintenance also prevents the spread of non-native weed species that may have invaded developed areas from spreading to other natural, undisturbed areas of the BMGR. Bird populations could potentially create problems for flight operations at the Gila Bend AFAF runway if not controlled. Additionally, pest management controls the insect and rodent populations that could potentially damage or disable valuable equipment and buildings that are crucial for completion of a successful military mission. Pest control is also important for the health and safety of persons working at these facilities.

4.9.3 Existing Regulatory and Statutory Requirements and Management Plans and Actions

All agencies with administrative or management responsibility on the BMGR are required to comply with applicable federal laws, and to the extent sovereign immunity has been waived, federal agencies are also required to comply with applicable state and local laws, including those related to grounds maintenance procedures. The identified regulatory and statutory requirements are summarized as follows.

4.9.3.1 Federal

Federal Insecticide, Fungicide, and Rodenticide Act

Federal facilities, including the BMGR, are affected by the Federal Insecticide, Fungicide, and Rodenticide Act because pesticide application occurs at those facilities. Registration includes approval by the EPA of the pesticide's label, which must give detailed instructions for its safe use."

Executive Order 13148

Signed into effect on 21 April 2000 by President Clinton, Executive Order 13148, "Greening the Government Through Leadership in Environmental Management," Part 2, Section 207, *Environmentally and Economically Beneficial Landscaping,* states that "Each agency shall strive to promote the sustainable management of Federal facility lands through the implementation of cost-effective, environmentally sound landscaping practices, and programs to reduce adverse impacts to the natural environment."

4.9.3.2 Department of Defense

DoD Instruction 4150.7

This instruction "implements policy, assigns responsibility, and prescribes procedures for the Department of Defense Pest Management Program, as established under references (a), (b), and the Joint Service Regulation, 'Joint Field Operating Agencies of the Office of the Surgeon General of the Army,' August 16, 1988."

DoD Regulation 4145.19

This regulation implements DoD Directive 4145.19 [*Storage and Warehousing Facilities and Services*, dated 13 August 1975], promulgates general policies, and delineates responsibilities concerning storage and warehousing facilities and services.

The provisions of this regulation apply to the military departments and the Defense Logistics Agency, worldwide. Heads of these DoD components may issue supplementary instructions only when necessary to provide for unique requirements within their respective components.

4.9.3.3 Air Force

2001 Pest Management Plan for Gila Bend AFAF and BMGR

As referenced earlier, this plan "... provides guidance for the management of pests at the Gila Bend AFAF and the BMGR. This plan is based upon DoD Instruction 4150.7, AFI 32-1053, Technical Information Memorandum No. 18, Contract #F02604-99-CM001, and the requirements of the State of Arizona. All installation pest management operations shall be based on [Integrated Pest Management,] which is a comprehensive approach to pest control or prevention which considers various chemical, physical and biological suppression techniques, the pest's habitat, and the interrelationship between the pest populations and the ecosystem."

Air Force Instruction 32-1053

This instruction "provides guidance for pest management programs at Air Force installations. It implements [Air Force Policy Directive] 32-10 *Installations and Facilities*, 27 March 1995 and Department of Defense Instruction 4150.7 *DoD Pest Management Program*, 22 April 1996."

Air Force Instruction 32-1074

"This instruction provides guidance for in-service and contract aerial application of pesticide projects at Air Force installations. It also provides guidance for the use of Air Force resources on

other Federal properties, non-Federal properties, and in foreign countries. It implements Air Force Policy Directive 32-10, *Installations and Facilities*, 14 April 1994, and Department of Defense Instruction 4150.7, *DoD Pest Management Program*, 22 April 1996."

4.9.3.4 Marine Corps

Marine Corps Order 5090.2

Marine Corps Order 5090.2, *Environmental Compliance and Protection Manual*, "implements the substantive requirements of DoD environmental policy; outlines the requirements for compliance with Federal environmental regulations; and establishes Marine Corps policy for funding, evaluating, and continually improving environmental compliance and protection programs, with emphasis on pollution prevention and training and education."

4.9.4 Information Not Currently Available to Support Grounds Maintenance

During the preparation of the affected environment section of this EIS, it was determined that pest management problems at BMGR facilities have not been thoroughly documented. Although pest management plans have been prepared that are applicable to Gila Bend AFAF and Cannon Air Defense Complex, plans have not been developed for other military use areas such as manned and tactical ranges. Information on the application of pesticides or herbicides according to the date, location, and amount is not available for any of the facilities. This does not constitute incomplete or unavailable information needed to conduct the environmental impact analysis presented in Chapter 5 in accordance with 40 CFR §1502.22.

4.10 PUBLIC UTILITIES AND TRANSPORTATION CORRIDORS

4.10.1 Existing Conditions

4.10.1.1 Study Scope and Geographic Location

The most recent inventory of public utilities and ground transportation features for the BMGR occurred during the process to renew the BMGR land withdrawal in 1997-98 and included areas within and immediately adjacent to the BMGR boundaries. Utilities included in the inventory consist of electrical transmission lines, major pipelines (natural gas and petroleum), and canals. Ground transportation corridors inventoried consist of roads, highways, and railroads. The study area for this discussion consists of adjacent lands within five miles of the BMGR perimeter boundary (hereinafter, perimeter study area or the study area). This five-mile buffer includes lands that are located within the state of Arizona and within Sonora, Mexico, whose border is

contiguous with that of the United States. In Arizona, the BMGR and surrounding area encompass portions of Yuma, Maricopa, and Pima counties.

Transmission lines identified in the inventory included lattice tower and wood-pole electrical transmission lines having a capacity of 115 kV or greater (i.e., 230kV, 345kV, 500kV). Electrical lines less than 115kV were considered distribution or sub-transmission lines and were too numerous to be included in the inventory. Major natural gas and petroleum pipelines that were greater than 8 inches in diameter were inventoried. Finally, primary canals used for residential and agricultural water distribution were also identified.

Ground transportation features consist of major roads and highways, such as interstate highways, federal highways, state highways, county and other major roads, and railroads. Interstate highways include any part of the national network of limited-access divided highways. Federal or state highways include all dedicated federal or state highway routes maintained by ADOT. County roads include all major roads maintained by the respective counties that represent major interconnections between interstate, federal, or state highways with major access routes in agricultural areas. Public utilities and ground transportation features within the range boundaries and on adjacent lands are included on Figure 4-18.

4.10.1.2 Public Utilities

Transmission lines

Existing transmission lines located in the BMGR public utilities study area are listed in Table 4-23.

TABLE 4-23
EXISTING TRANSMISSION LINES IN THE BMGR VICINITY

Owner	Capacity of Line (kV)	Location
San Diego Gas and Electric	500	Runs from northeast of the North Gila Electrical Substation and passes through the substation before continuing on to the west, north of Yuma.
San Diego Gas and Electric	161	Runs from the Gila Substation located east of Yuma and roughly parallels Interstate 8 through Telegraph Pass to the Wellton area.
Department of Energy	161	Extends from the Gila Substation and extends north out of the perimeter study area, paralleling U.S. Highway 95

The Ajo Improvement Company, a subsidiary of Phelps Dodge Corporation, has obtained a right-of-way grant to construct and operate a 230kV transmission line extending from Gila Bend to Ajo. The future electrical demand would result from the proposal to reopen the Phelps Dodge

Ajo Incorporated (PDAI) Mine. The line is being proposed to run from the Gila Bend Substation on the west side of Gila Bend to a proposed substation that would be located near the PDAI Mine on the southeast side of Ajo. The transmission line would roughly parallel the existing Arizona Public Service Company Gila Bend to Ajo 69kV power line and Arizona State Route 85. To date, no immediate plans are in place for construction of the transmission line because the PDAI Mine will not reopen with the current low market price of copper. Once Phelps Dodge decides to reopen the mine, the Ajo Improvement Company will begin construction of the transmission line; however, no date has been scheduled for reopening the mine (Stillwell 2000).

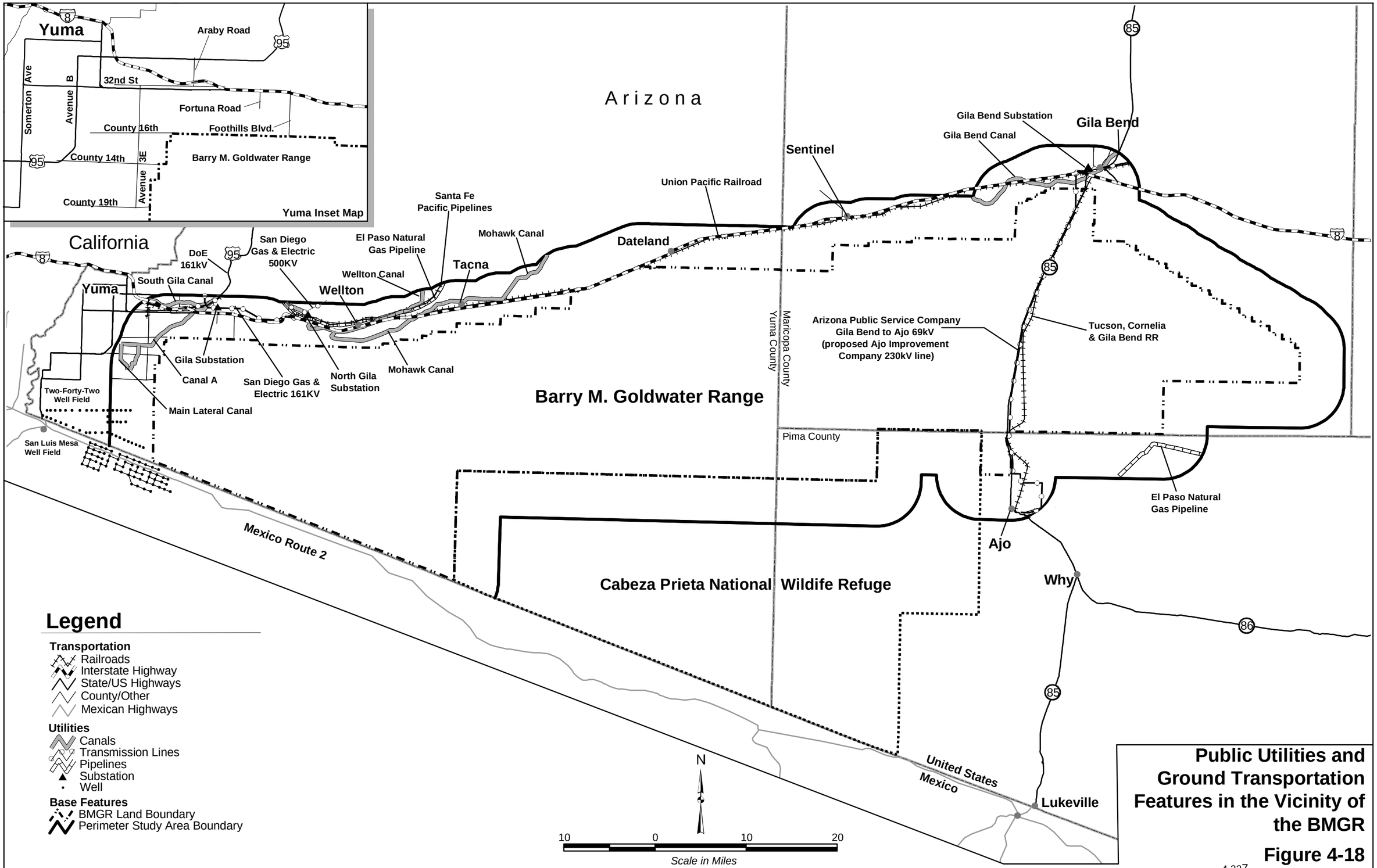
Another proposed transmission line would extend from Santa Rosa to Gila Bend, roughly following Maricopa Road into the community of Gila Bend. The Certificate of Environmental Compatibility has been issued by the Arizona Corporation Commission and right-of-way has been acquired for the line. The proposal is still in Arizona Public Service's 10-year plan, and the anticipated construction date is 2006 (Stoltine 2001).

Pipelines

Pipelines within the perimeter study area are located near the BMGR boundary and serve urban, mixed use, and rural residential developments. Major pipelines include natural gas and petroleum lines, and those located in the vicinity of the BMGR are included in Table 4-24.

TABLE 4-24
EXISTING NATURAL GAS AND PETROLEUM PIPELINES IN THE BMGR VICINITY

Owner	Type	Size of Pipeline (inches)	Location
El Paso Natural Gas Company	Natural Gas	12	In the Yuma area about four miles north of the BMGR
El Paso Natural Gas and Southwest Gas	Natural Gas	8	Extends from the Dome Valley along Interstate 8 for about 9 miles into the Wellton area
El Paso Natural Gas	Natural Gas	8	In the Ajo area. Known as the Ajo to Casa Grande pipeline
Santa Fe Pacific Pipeline Company	Petroleum	20	Phoenix to California (operates 24 hours/day). Parallels the Union Pacific Railroad along Interstate 8 to Wellton and then northeast out of the study area.
Santa Fe Pacific Pipeline Company	Petroleum	12	Phoenix to California (currently dormant). Parallels the Union Pacific Railroad along Interstate 8 to Wellton and then northeast out of the study area


Yuma
Araby Road
32nd St
Somerton Ave
Avenue B
Fortuna Road
County 16th
Foothills Blvd.
County 14th
Barry M. Goldwater Range
Avenue 3E
County 19th
Yuma Inset Map
Arizona
California
Yuma
DoE 161kV
San Diego Gas & Electric 500KV
El Paso Natural Gas Pipeline
Santa Fe Pacific Pipelines
Mohawk Canal
Wellton Canal
Tacna
Wellton
Dateland
Union Pacific Railroad
Sentinel
Gila Bend Substation
Gila Bend Canal
Gila Bend
South Gila Canal
Gila Substation
Canal A
San Diego Gas & Electric 161KV
North Gila Substation
Mohawk Canal
Main Lateral Canal
Two-Forty-Two Well Field
San Luis Mesa Well Field
Barry M. Goldwater Range
Maricopa County
Yuma County
Pima County
Arizona Public Service Company Gila Bend to Ajo 69kV (proposed Ajo Improvement Company 230kV line)
Tucson, Cornelia & Gila Bend RR
El Paso Natural Gas Pipeline
Ajo
Why
Mexico Route 2
Cabeza Prieta National Wildife Refuge
United States
Mexico
Lukeville
Legend
Transportation
Railroads
Interstate Highway
State/US Highways
County/Other
Mexican Highways
Utilities
Canals
Transmission Lines
Pipelines
Substation
Well
Base Features
BMGR Land Boundary
Perimeter Study Area Boundary
N
10 0 10 20
Scale in Miles
Public Utilities and Ground Transportation Features in the Vicinity of the BMGR
Figure 4-18
4-227
g:\bmgr\gis\projects\mxd\inrmp\figure_4_18.mxd

Canals

Canals located adjacent to the BMGR are associated with agricultural and urban areas in the vicinity of Yuma, Wellton, and Gila Bend. In Yuma, the primary canals are the Main Lateral canal that extends south from MCAS Yuma, about four miles from the BMGR, and the "A" Canal that extends along the western perimeter of the BMGR and comes within one mile of the northwestern corner of the range. In Wellton, several canals serve the vast agricultural areas, but the primary canals are the Wellton and Mohawk canals. The Gila Bend Canal runs from north of the town of Gila Bend, paralleling Interstate 8 to Paloma Ranch on the west. In Mexico, a canal system, referred to as the San Luis Mesa Well Field, is located to the east of San Luis de Colorado, Sonora. Another canal system was authorized by the passage of Minute 242 (an extensive well field) of the International Boundary and Water Commission. This well field, known as the Two-Forty-Two Well Field, is located in Arizona along the international border between San Luis de Colorado and the BMGR (U.S. Air Force 1986).

No proposed canals have been identified for areas within the perimeter study area.

4.10.1.3 Ground Transportation

Highways and Roads

During the inventory of ground transportation for the BMGR range renewal in 1997-98, four subcategories of surface transportation were identified within and adjacent to the BMGR. These include: (1) Interstate highways, (2) Mexican highways, (3) State highways, and (4) county/other roads.

In general, the lands located adjacent to the BMGR are sparsely developed, requiring few transportation routes. Other than Interstate 8, Mexico Route 2, and State Route 85, the most heavily traveled transportation routes are located in the Yuma area. Table 4-25 provides average daily traffic counts for transportation routes in the BMGR perimeter study area.

TABLE 4-25
TRAFFIC COUNTS FOR ROADS WITHIN THE PERIMETER STUDY AREA

	1999 Average Daily Traffic Counts
Interstate 8	
Exit 2—U.S. 95	21,000
Exit 30—Wellton	9,466
Exit 119—Gila Bend	5,000
Exit 161—Stanfield Road	7,292
State Route 85	
6th Street—Ajo	6,189

TABLE 4-25
TRAFFIC COUNTS FOR ROADS WITHIN THE PERIMETER STUDY AREA

	1999 Average Daily Traffic Counts
Mexico Route 2	
Sonoita	3,470
Los Vidrios	2,789
San Luis Rio Colorado	5,554
County/Others	
Dome Valley Road (north of Old U.S. 80)	930
Fortuna Road (north of Interstate 8)	5,133
Foothills Boulevard (south of Interstate 8)	10,370
Araby Road (north of B-8)	7,223
Avenue 3E (south of 14th Street)	4,897
County 14th (east of 4th Avenue exit)	3,530
County 16th (east of Avenue B)	3,193
Avenue B (south of 20th Street)	23,060
Gila Bend Air Base Entrance	2,144

Sources: 1999 data obtained from Arizona Department of Transportation 1999, Yuma Metropolitan Planning Organization 2001, and Mexican Institute of Transport 2001.

Mexico Highway 2 connects Sonoyta to San Luis and is the main east-west corridor south of the BMGR boundary. Located approximately five miles south of the BMGR/international border, Mexico Highway 2 is a two-lane highway that passes through several *ejidos*, or communally owned farms. There are plans to improve this highway to a four-lane divided highway.

The Yuma ASH has been proposed by the Yuma Metropolitan Planning Organization to connect Interstate 8 with the city of San Luis and a new commercial port-of-entry east of San Luis. This highway will be approximately 25 miles in length and will improve the transportation of trade and freight between the United States and Mexico. An EA for the project is being prepared to comply with NEPA. Project construction will occur in phases, with the first phase expected to begin in 2002. A portion of the Yuma ASH is planned to be located along the western boundary of the BMGR; however, this portion of the highway would be fenced to restrict access to the range. Construction of this portion of the highway is expected to occur in 2005 (Gross 2001).

Railroads

Three primary railroad lines are located within the perimeter study area. Two Union Pacific Railroad lines are located north of the BMGR. One line extends from east of Gila Bend, paralleling Interstate 8 along the northern perimeter of the BMGR, through Sentinel, Tacna, Wellton, and Yuma. The other Union Pacific Railroad line splits from this line east of Wellton, and then extends to the northeast out of the perimeter study area through the community of Hyder. The third line, operated by Tucson, Cornelia, and Gila Bend Railroad, extends from Ajo to Gila Bend through the BMGR, roughly paralleling State Route 85, with the primary purpose of serving the PDAI Mine. Upgrades to the railroad were made (in about 1997) for use during the

construction and operation of the mine to haul concentrate when the concentrator is in operation. Although the PDAI Mine is currently inactive, Phelps Dodge Corporation has proposed to reopen the mine when the market price of copper increases.

4.10.1.4 Right-of-Way Management Authority

In accordance with the land management responsibilities assigned in P.L. 99-606, the BLM has been the responsible agency for granting utility easement rights-of-way through BMGR lands. Under P.L. 106-65 (the MLWA of 1999), however, the secretaries of the Navy and the Air Force assumed this responsibility after 6 November 2001. However, Section 3013(a)(5) of the MLWA of 1999 titled "Changes in Use" states that "the Secretary of the Navy and the Secretary of the Air Force shall consult with the Secretary of the Interior before using the lands withdrawn and reserved by this section for any purpose other than the purposes specified [in Section 3013(a)(2)]." Thus, BLM consultation would be required for the Air Force and/or Marine Corps to issue a right of way that is not for the military purposes specified in Section 3013(a)(2) of the MLWA of 1999.

DoD's policy on granting rights-of-way would be addressed in accordance with DoD Directive 4165.6, *Real Property Acquisition, Management, and Disposal*; Section 6.2.3 of this directive states "...Unimproved lands (e.g. buffer, safety, restrictive or maneuver areas) or other real property, temporarily not needed for DoD use, may be outgranted when interim usage will not interfere with the purpose for which the real property is held by the Department..." Section 6.2 of the directive addresses management of real property and states "The DoD Components shall ensure that real property holdings under their control are being used to the maximum extent possible consistent with peacetime and mobilization requirements. Each Military Department shall maintain a program monitoring the use of real property." AFI 32-9003 provides Air Force guidance for implementing this directive and includes issues such as financial compensation, right-of-way and easement widths, consent agreements, repair and restoration of government property, and removal of improvements.

Additionally, the military law regarding easements for gas, water, and sewer pipeline rights-of-way is addressed in 10 U.S.C. 2669, which states: "If the Secretary of a military department finds that it will be in the public interest and will not substantially injure the interest of the United States in the property affected, he may grant, upon such terms as he considers advisable, easements for rights-of-way over, in, and upon public lands permanently withdrawn or reserved for the use of that department, and other lands under his control, for gas, water, and sewer pipe lines..." The law also states that no easement may include more land than necessary; the Secretary may terminate the easement for failure to comply with the terms, two-year non-use, or abandonment; and the Secretary shall include the details of such an easement in his annual report to the President.

Similarly, the Secretary of a military department may grant easements across public lands or lands under his control for other types of rights-of-way, such as railroad tracks, canals, roads, power lines, etc. if it is not against public interest, and under advisable terms (10 U.S.C. 2668). Copies of instruments for granting easements are to be furnished to the Secretary of the Interior.

4.10.2 Interrelationship Between the Military Mission and Public Utilities and Transportation

The operation of existing and construction of additional public utilities or transportation corridors on the range must be compatible with the existing or reasonably foreseeable future military mission and associated safety and security requirements. Overhead power lines within the BMGR must be designed in consideration of the low-level airspace use.

At the same time, the military relies on public utilities and transportation routes to carry out its mission. The Marine Corps and Air Force use public roadways and utilities on BMGR—West and BMGR—East for several activities.

4.10.2.1 BMGR—West

- Access to Cannon Air Defense complex via County 14th Street
- Access to rifle range, AUX-2, Moving Sands and Cactus West target complexes, live ordnance jettison areas, ground support areas, and EOD operating area (all west of the Gila Mountains) from MCAS Yuma via County Avenue 3E and 19th Street
- Access to ground support areas, TACTS Range facilities, and other BMGR—West locations (between the Gila Mountains and the Mohawk Mountains) via County 3E, U.S. Highway 80 and Interstate 8 during WTI Courses
- Withdrawal of water from the Wellton-Mohawk Irrigation District canals along the northern part of the BMGR for Marine Corps field exercises

4.10.2.2 BMGR—East

- Access to tactical and manned ranges, Stoval Auxiliary Airfield, AUX-6, Air Force small arms range, Gila Bend AFAF EOD Training Area, and other BMGR—East locations via State Route 85 or Interstate 8
- Access to Childs Mountain communication and telemetry site on Childs Mountain

Both the Marine Corps and Air Force utilize the few utilities (i.e., electricity, telephone) on the BMGR that serve various sites throughout the range, including Gila Bend AFAF, manned ranges, Cannon Air Defense Complex, selected TACTS Range facilities via distribution lines

from existing utilities. Gila Bend AFAF utilizes an on-site wastewater treatment facility, along with a non-potable well. Potable water for Gila Bend AFAF is purchased commercially.

State Route 85 and Interstate 8 are also used by members of the public visiting the BMGR. Consequently, the military ensures that these areas are adequately signed and properly managed for both military ground personnel and non-military visitors. Proper signs must be maintained so that visitors are aware of areas that are restricted from access for safety or environmental protection.

4.10.3 Existing Regulatory and Statutory Requirements and Management Plans and Actions

After 6 November 2001, the Secretary of the Navy and the Secretary of the Air Force became responsible for processing utility right-of-way applications for lands within the BMGR. Under the provisions of the MLWA of 1999, however, as detailed in Section 3031(a)(5), "the Secretary of the Navy and the Secretary of the Air Force shall consult with the Secretary of the Interior before using the lands withdrawn and reserved by this section for any purpose other than the purposes specified, which include testing, training, and other defense-related purposes. Therefore, the BLM must be consulted if a utility or transportation corridor has the potential to encumber the land somehow. This type of consultation is of particular interest to the BLM because land management would be transferred back to BLM if the Secretaries of the Navy and Air Force determine there is no continuing military need for the lands withdrawn and the Secretary of the Interior is notified of the military's intent to relinquish jurisdiction of the lands (Section 3031(f)(1) of the MLWA of 1999).

Per 10 U.S.C. 2668, "if the Secretary of a military department finds that it will not be against the public interest, he may grant, upon such terms as he considers advisable, easements for rights-of-way over, in, and upon public lands permanently withdrawn or reserved for the use of that department, and other lands under his control, to a State, Territory, Commonwealth, or possession, or political subdivision thereof, or to a citizen, association, partnership, or corporation of a State, Territory, Commonwealth, or possession, for railroad tracks; oil pipe lines; substations for electric power transmission lines and pumping stations for gas, water, sewer, and oil pipe lines; canals; ditches; flumes; tunnels; dams and reservoirs in connection with fish and wildlife programs, fish hatcheries, and other improvements relating to fish-culture; roads and streets; poles and lines for the transmission or distribution of electric power; poles and lines for the transmission or distribution of communications signals (including telephone and telegraph signals); structures and facilities for the transmission, reception, and relay of such signals; and any other purpose that he considers advisable..."

For lands located near the BMGR, the BLM grants utility rights-of-way. BLM-administered public lands are subject to the multiple use management objectives of FLPMA. In designating

right-of-way corridors and determining whether to require that future utility easements be confined to them, BLM considers federal and state land use policies, environmental quality, economic efficiency, safety, and good engineering and technological practices.

The Lower Gila South Resource Management Plan (Goldwater Amendment) requires that any construction of overhead transmission lines be parallel and close to the existing Gila Bend to Ajo 69kV transmission line, which itself parallels State Route 85.

4.10.4 Information Not Currently Available to Support Public Utilities and Transportation Corridor Management

No data or information needs pertaining to the granting and management of utility easement rights-of-way through BMGR lands were identified during the preparation of the affected environment section of this EIS.

4.11 SPECIAL MANAGEMENT AREAS

4.11.1 Existing Conditions

4.11.1.1 Introduction and Background

There are a number of areas on the BMGR that have been assigned special land management designations in recognition of certain resource or recreation values. The special land management designations in existence today for areas of the BMGR are largely the result from the legacy of recognition enacted on 3 December 1982 under the Arizona State Parks State Natural Areas program and, in the case of Tinajas Altas ACEC, efforts to expand the Cabeza Prieta NWR. After BMGR natural and cultural resource management responsibility was assigned to the BLM with the MLWA of 1986, the former State Natural Areas and other areas were recognized with the establishment of BLM management designations for certain lands when the Lower Gila South RMP (Goldwater Amendment) was enacted in 1990. These BLM designations—three ACECs, two SRMAs, an HMA, and a Backcountry Byway—provide the primary management framework in place today. In 1997, however, the HMA designation was modified by the implementation of the interagency flat-tailed horned lizard management strategy to encompass a representative range of this species. With the passage of the MLWA of 1999, it is appropriate, once more, to review the existing special land management designations and associated management actions. Portions of the Sentinel Plain SRMA were not included in the 1999 BMGR land withdrawal and this EIS will describe these changes. Of the 1,733,921 acres of land included in the BMGR as a result of the passage of the MLWA of 1999, approximately 448,408 acres fall within these specially designated land management areas.

4.11.1.2 Overview of Existing Conditions

Since 1990, specially designated areas on the BMGR have been managed by the BLM in accordance with the guidelines established in the Lower Gila South RMP (Goldwater Amendment). This amendment was written to comply with P.L. 99-606 and FLPMA. The RMP addresses the management of non-military use and natural and cultural resources on the 1,842,423 acres of public land in the eastern and western sections of the BMGR (U.S. DOI, BLM 1990b). The most important land use management action in the RMP was the designation of preservation and recreation management areas within the BMGR. The RMP contains specifications regarding acreage and resource qualities for BMGR areas designated as preservation or recreation management areas (Table 4-26). In addition, the RMP also contained management prescriptions for each of these areas.

TABLE 4-26
BLM SPECIAL MANAGEMENT AREAS WITHIN THE BMGR

BLM Designation	Name	Acreage	Resource Qualities
ACEC	Tinajas Altas Mountains	60,500	· contains floral, faunal, scenic, and cultural resource qualities of more than local significance
	Gran Desierto Dunes	25,500	· contains the northern portions of the Gran Desierto dune system, the largest active dune system in North America · the dune system is limited in occurrence, and is unique and rare biologically
	Mohawk Mountains and Sand Dunes	132,000	· contains the Mohawk Mountain Range and the semi-stabilized sand dune system to the west of the mountain range. The sand dune system, two miles across at its widest point, is the largest in Arizona. · contains significant biological and geological resource qualities and is of more than local significance due to its rarity, large size, and undisturbed condition
SRMA	Sentinel Plain Lava Flow	92,000 (reduced to 80,000 with MLWA of 1999)	· encompasses 144 of the 225 total square miles of the largest lava flow in southern Arizona (82 square miles are located north of Interstate 8) · established because the area possesses resource qualities giving it regional distinctiveness and recreational opportunities
	Crater Range	11,920	· covers the eastern edge of the Crater Range and is divided by State Route 85 · the heavily eroded mountain terrain is scenic and provides a recreation resource to highway travelers
Habitat Management Area	Yuma Desert and Sand Dunes	84,500 (increased to 131,200 in 1997)	· designated to preserve flat-tailed horned lizard habitat · Flat-tailed Horned Lizard Rangewide Management Strategy increased this HMA to 131,200 acres (Foreman 1997)

TABLE 4-26
BLM SPECIAL MANAGEMENT AREAS WITHIN THE BMGR

BLM Designation	Name	Acreage	Resource Qualities
Backcountry Byway	El Camino del Diablo	19,200	· El Camino del Diablo includes the portion of the rough, historic route used for travel across southern Arizona and portions of Sonora, Mexico · the backcountry byway designation begins at the western boundary of the Cabeza Prieta NWR and diverges into an east/west route; the byway extends one-quarter mile on each side of the road within the BMGR · the BLM proposed backcountry byway designation does not apply within the Cabeza Prieta · portions of El Camino del Diablo are listed in the National Register of Historic Places
Source: U.S. DOI, BLM 1990b			

The ROD to the RMP designated 218,000 acres of the BMGR as ACECs and 103,920 acres as SRMAs. The ROD also designated 84,500 acres as an HMA and established 19,200 acres of El Camino del Diablo (a road with segments listed on the National Register of Historic Places) as a Backcountry Byway.

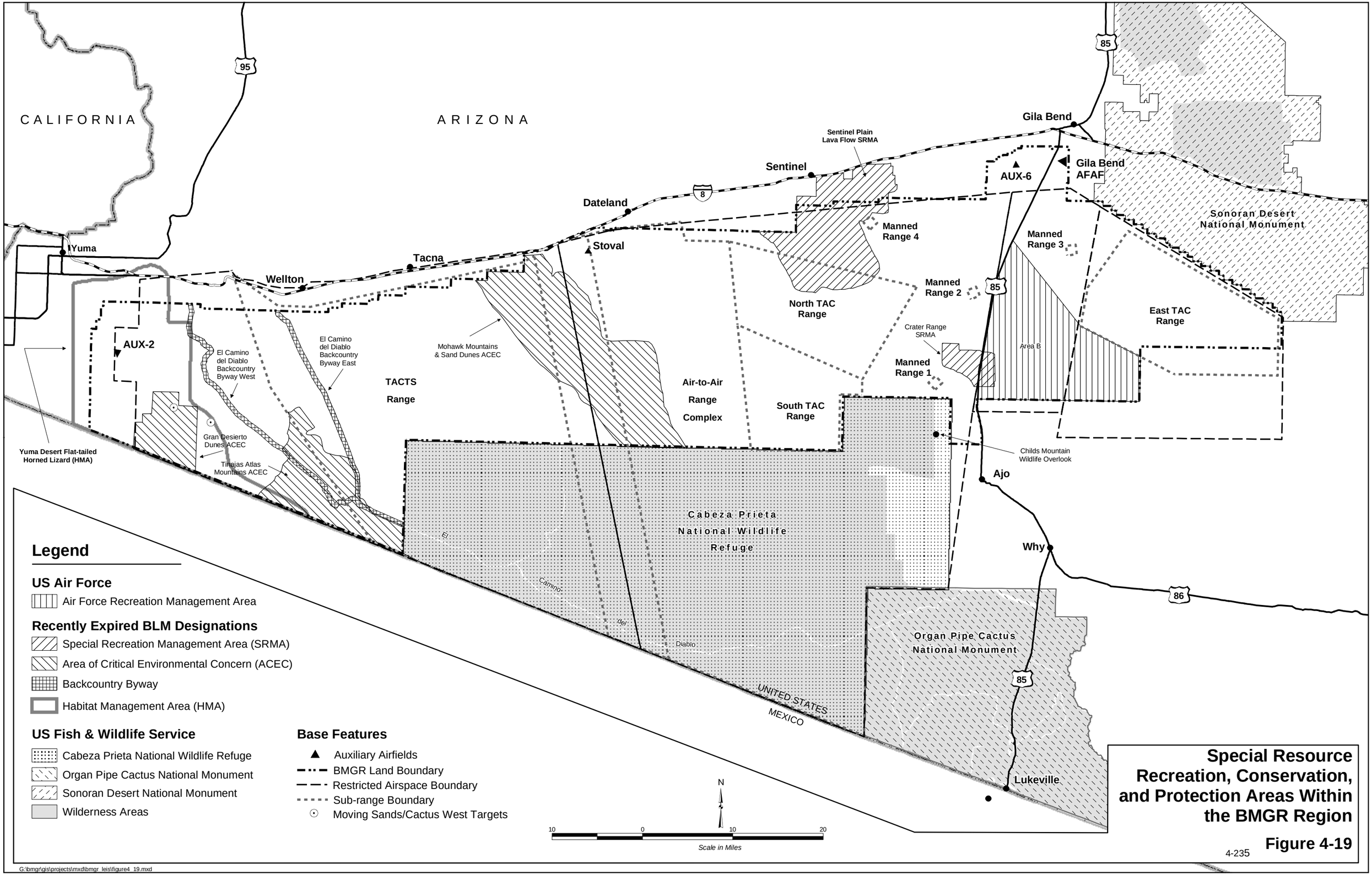
Designations of the ACECs, SRMAs and the Backcountry Byway have remained much the same since the publication of the RMP. However, with the adoption of the interagency flat-tailed horned lizard management strategy, the HMA was expanded to include additional lands both within and outside of the BMGR boundaries. Not all of the land comprising the Sentinel Plain Lava Flow SRMA was included in the BMGR land withdrawal established by the MLWA of 1999. Figure 4-19 depicts the special management areas designated on the BMGR and Figure 2-4 in Chapter 2 shows the military facilities that are within these special management areas.

4.11.1.3 Areas of Critical Environmental Concern

The BLM defines ACECs as areas where special management attention or action is needed to protect or preserve important natural or human resource values or protect human lives from natural hazards. The following three ACECs were first identified for management under the RMP.

Tinajas Altas Mountains ACEC

The Tinajas Atlas Mountains ACEC is located within BMGR—West with its southern boundary along the international border and a portion of its eastern boundary adjacent to the Cabeza Prieta NWR. The Tinajas Altas, or High Tanks, is a large desert mountain range located within this ACEC that is a highly scenic, classic geologic example of a northwest-to-southeast-trending



Special Resource Recreation, Conservation, and Protection Areas Within the BMGR Region

Figure 4-19

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granitic range. The tinajas, or slickrock water tanks, are among the best examples of true tinajas and, due to their depth, many animal species tend to congregate at the tinajas, particularly in times of drought. Prehistorically and historically, Tinajas Altas was culturally the most important tinaja in the Western Papaguería as it was the most reliable source of water along El Camino del Diablo between the Rio Sonoyta and Colorado rivers, a distance of more than 100 miles (Hartmann and Thurtle 2000). Its importance is indicated by evidence of 9,000 years of use. Over time, the weathering of the granitic mountain surfaces has created a variety of micro-climates for an unusually diverse mixture of plants and animals not normally found in such a hot and arid area. The mountains provide habitat for desert bighorn sheep. Other plant and animal species present in the area include the red-spotted toad, ironwood, elephant tree, Bigelow beargrass, and Kearney sumac.

Management prescriptions for the Tinajas Altas Mountains ACEC, identified in the Lower Gila South RMP, Goldwater Amendment, include:

- Limiting military ground operations to designated or established roads
- Removing military ground operation sites within the ACEC
- Limiting all vehicle use to designated roads
- Marking all non-essential roads as closed to vehicle use
- Closing the multiple roads and vehicle trails leading from El Camino del Diablo to the main Tinajas Altas rock pool complex and establishing only one primary public travel route
- Establishing a hiking trail to the lower Tinajas Altas pool, with the trailhead and vehicle management structures designed to allow access to the water holes during drought periods
- Prohibiting camping within one-quarter mile of the Tinajas Altas High Tanks area
- Prohibiting woodcutting and the taking of dead or downed trees
- Establishing long-term study plots to inventory and monitor natural resources
- Establishing interpretive facilities describing the geologic, plant, wildlife, and cultural components of the ACEC

Gran Desierto Dunes ACEC

The Gran Desierto Dunes ACEC is located in the southwest portion of BMGR—West. Comprised of approximately 25,500 acres of native Sonoran Desert land, the area contains unique plant and animal elements within its nearly untouched and rare dune system. The dune system is made up of active crescent dunes with relatively few linear dunes, but includes a number of crescent dunes surrounded by sandy flats. Other special resource qualities in this ACEC include habitat for the fringe-toed lizard and a variety of dune endemic plants including *Helianthus niveus* ssp. *tephrodes*, *Ammobroma sonorae*, *Euphorbia platysperma* and *Eriogonum deserticola*. This ACEC is presently located within a Marine Corps training area that is closed to civilian visitation because of air-to-ground ordnance delivery.

The RMP (U.S. DOI, BLM 1990b) designates several management prescriptions for this ACEC, including:

- Limiting or excluding vehicle use to designated roads
- Establishing interpretive facilities and information describing the geologic, floral, and fauna components of the Yuma Desert/Sand Dunes (see Figure 4-1) and Gran Desierto Dune system complex
- Prohibiting woodcutting or taking of dead or downed trees within the area
- Prohibiting new rights-of-way and other land use authorizations
- Encouraging military ground activities to stay within current training areas
- Establishing long-term study plots to inventory and monitor natural resources
- Reclaiming military use areas with surface damage if the areas are identified as non-essential to current or future military training missions

Mohawk Mountains and Sand Dunes ACEC

The Mohawk Mountains and Sand Dunes ACEC is situated along the northern border of the Cabeza Prieta NWR and extends across portions of BMGR—East and BMGR—West. The ACEC is located south of Interstate 8 and 13 miles south of the city of Dateland. The Mohawk Mountains and Sand Dunes ACEC is a semi-stabilized dune field alongside the mountain range. Most of the dunes system is west of the Mohawk Mountains and lies before a playa depression. The dune field, two miles across at the widest point, is the largest and least disturbed sand dune system in southern Arizona. The Mohawk Mountains are a high-relief, long, narrow wall-like mass of metamorphic rock. Because of the dry climate, the relatively young age of the range, the narrowness of the range, and erosion-resistant nature of the rock, the Mohawk Mountains are among those ranges in the Basin and Range Physiographic Province that are most resistant to downcutting.

The Mohawk Mountains and Sand Dunes are home to many desert animals and plants. Notably, plant species in the area include elephant trees, Indian tea, Schott's wire lettuce, and sand food. Animal species include fringe-toed lizards, sidewinder rattlesnakes, pocket gophers, mule deer, bobcats, coyotes, woodrats, kit foxes, jackrabbits, and nighthawks. The area is also inhabited by desert bighorn sheep and Sonoran pronghorn.

Management prescriptions established in the RMP (U.S. DOI, BLM 1990b) for this ACEC include:

- Limiting vehicle use to designated roads
- Prohibiting vehicle traffic to all sand dune areas

- Establishing interpretive facilities and information describing the geologic, floral, and fauna components of the Mohawk Mountains and Sand Dunes ACEC
- Prohibiting woodcutting or taking of dead or downed trees within the area
- Establishing long-term study plots to inventory and monitor natural resources per the existing Air Force Ecosystem Management Plan (also known as the *Luke Air Force Range Natural Resources Management Plan* (U.S. Air Force 1986))
- Prohibiting new rights-of-way and other land use authorizations except within the Interstate 8 utility corridor
- Installing below ground utility services, unless overhead facilities are required due to technical and/or operational circumstances
- Encouraging military ground training activities to remain within current use areas within the ACEC
- Reclaiming military use areas identified as non-essential to current or future military training missions
- Establishing the portion of Interstate 8 bordering the north boundary of the ACEC as a Scenic Byway in coordination with ADOT

4.11.1.4 Special Recreation Management Areas

SRMAs are areas that are recognized for containing resources of potential value to recreation, but do not meet the criteria for designation as an ACEC.

Two SRMAs, the Sentinel Plain Lava Flow and Crater Range, are designated within the BMGR. Although the resource of the SRMAs in the BMGR is acknowledged, most of these areas are restricted from recreational use due to public health and safety requirements. Though both SRMAs possess resource qualities that give them regional distinctiveness, no threatened or endangered wildlife or plant species are known to inhabit either of the locations. In addition, no circumstances are present or anticipated that would alter or modify existing natural resource conditions within the SRMAs.

<u>Sentinel Plain Lava Flow SRMA</u>

The Sentinel Plain Lava Flow SRMA represents the largest lava flow in southern Arizona. The lava flow in the Sentinel Plain area is virtually flat. Portions of the plain surface are covered with recent eruptions showing little sign of erosion or weathering. The plain, also known as a mesa, is nearly 100 feet thick and is composed primarily of olivine basalt. The surface consists of desert pavement or accumulations of large, angular stones.

The most common plants on the Sentinel Plain are creosotebush and bursage. Some saguaro and small stunted paloverde trees occur occasionally along the plain. Due to the rocky surfaces, lack

of soil, and arid and hot conditions, the plant community is sparse and scattered. Some birds, reptiles and mammals common to the Sonoran Desert live in the area, but populations are not abundant.

Several management prescriptions have been established for the Sentinel Plain Lava Flow SRMA (U.S. DOI, BLM 1990b). These prescriptions attempt to maintain recreation, geologic and educational features while operating within the constraints of the military mission. Accordingly, prescriptions include:

- Limiting vehicle use to designated roads
- Establishing point-of-interest interpretive facilities and signs that describe features of geologic interest near Interstate 8 and at major entry points
- Prohibiting new rights-of-way in the area and installing utilities below ground unless overhead facilities are required due to technical and/or operational circumstances
- Minimizing visual impacts on the area's geologic formations)

The Sentinel Plain Lava Flow SRMA is located in an area with potential safety conflicts between recreation and military use. Its position due west of Range 4 places it immediately down range of the air-to-ground strafe pattern of that range. Public visitation to the SRMA is therefore restricted. In some circumstances, access may be allowed with a special use permit.

Crater Range SRMA

The Crater Range SRMA is located in the central portion of BMGR—East, approximately 27 miles south of Gila Bend. Bisected by State Route 85, the SRMA's eastern portion is located in Air Force Recreation Management Area B while the western portion is situated between Manned Ranges 1 and 2.

The Crater Range SRMA consists of a heavily eroded mountain range of primarily volcanic material. The Tertiary volcanics have been subject to mechanical erosion through arid conditions and other weathering processes. Crater Range SRMA supports a wide variety of natural Sonoran Desert vegetation. Although the area is scenic and contains interesting geologic and plant features, these features are similar to other Tertiary volcanic landscapes in the state. No threatened or endangered plant or wildlife species are represented in this area.

Recreation use in the western portion of the SRMA is restricted because of its position adjacent to Manned Ranges 1 and 2 and North TAC (U.S. Air Force 1997b). While recreation within the portion of the Crater Range SRMA that is west of State Route 85 is not appropriate, the SRMA designation allowed for recognition of the resource values of this area.

To maintain the visual appeal of the Crater Range SRMA, management prescriptions identified in the RMP (U.S. DOI, BLM 1990b) include:

- Limiting vehicle use to designated roads
- Posting point-of-interest interpretative signs and maintaining picnic areas along State Route 85
- Prohibiting new rights-of-way and limiting potentially adverse visual impacts associated with new developments in the existing utility corridors

4.11.1.5 Habitat Management Area

HMAs are areas recognized for their wildlife and botanical resources, but do not meet the criteria to be designated as an ACEC. The HMA is afforded much of the same protection as the ACECs; however, more emphasis is placed on habitat protection and less on recreational use.

Yuma Desert and Sand Dunes HMA

The Yuma Desert and Sand Dunes HMA is located in the western portion of BMGR—West, and encompasses the Gran Desierto Dunes ACEC. Originally 84,500 acres in size, the BLM expanded the area to include approximately an additional 24,125 acres to include additional dune-fringe areas representing habitat for the flat-tailed horned lizard and other plants and wildlife of the Yuma Desert.

In 1997, a group comprised of state and federal agencies known as the Flat-tailed Horned Lizard Working Group of Interagency Coordinating Committee developed and signed a cooperative agreement to implement the Flat-tailed Horned Lizard Rangewide Management Strategy. With this agreement, the Yuma Desert and Sand Dunes HMA increased to approximately 131,000 acres.

Management prescriptions identified in the RMP (U.S. DOI, BLM 1990b) for the Yuma Desert and Sand Dunes HMA include:

- Limiting vehicle use to designated roadways with no cross-country or dune travel
- Establishing interpretive facilities and information signing near major access points to describe the geologic, floral, and fauna components of the HMA
- Prohibiting woodcutting for commercial or domestic use
- Limiting new rights-of-way in flat-tailed horned lizard habitat
- Discouraging expanded training and target use in the sand dune and other fragile habitat areas through coordination with the military

- Reclaiming military use areas with surface damage within the HMA if the military use is identified as non-essential to current or future military training missions, but only if areas have a potential for successful reclamation as determined by BLM Surface Reclamation Specialists.

4.11.1.6 Backcountry Byway

Backcountry Byways are scenic corridors that pass through areas with scenic, natural, historic, and/or prehistoric values. One Backcountry Byway is located within the BMGR.

El Camino del Diablo

El Camino del Diablo (The Devil's Highway) is a rough, unpaved route crossing the BMGR. First used by Native Americans for their travels, the route was chosen by the Spanish soldier Melchior Diaz in 1540. Other historic figures followed, including Father Kino, Father Garces, and Juan Bautista de Anza. Beginning in 1849, the trail was used by immigrants from Mexico as a route to the California gold fields. Between 400 and 2,000 people died of thirst along the trail, making the Camino the deadliest immigrant trail in North America (U.S. DOI, BLM 2001b; U.S. Fish & Wildlife 1995).

El Camino del Diablo emerges from the western boundary of the Cabeza Prieta NWR and divides into two north/south routes extending toward the northern boundary of the BMGR. Management prescriptions identified in the BLM RMP (U.S. DOI, BLM 1990b) include:

- Prohibiting surface-disturbing activities within one-quarter mile of the roadway
- Prohibiting firewood collection within 150 feet of the byway corridor and allowing only dead and downed wood to be collected beyond this 150-foot corridor
- Permitting vehicle-based and self-contained camping only within 50 feet of the roadway unless otherwise posted
- Installing interpretative and visitor use signs along the trail to describe appropriate cultural, geologic, and biological features
- Reclaiming military use areas with soils and plant damage when and if present training areas are identified as non-essential to current or future military training missions
- Limiting new rights-of-way, other land use authorizations, and surface disturbances in the backcountry byway and scenic corridor

4.11.2 Interrelationship Between the Military Mission and Special Management Areas

All uses on the BMGR must be consistent with the military purposes for which the range was established. Therefore, any management standards considered for special natural/interest areas

must consider the existing and potential military needs within the area. Similarly, while special management designations may be assigned to an area, public use of the area may still be precluded because of the public safety issues associated with the military activities in that area. The SRMAs on the BMGR are an example of this in that recreation could not be allowed within most of the land within the SRMAs because of their proximity to the manned and tactical ranges where live firing of ordnance occurs.

However, there has also been a legacy of acknowledging the unique resource values associated with certain areas on the BMGR through special management designations. The BLM established management prescriptions for specially designated areas to better preserve these resource values within the context of the range. In recognition of the importance of preserving habitat, scenic and historic values, unique geological landforms, and other natural features for future generations, DoD has worked closely with resource managers to minimize the military effects within areas with special management designations. For example, the Marine Corps agreed to remove a ground support area located within the area that the BLM proposed to designate as the Tinajas Altas Mountains ACEC in the Lower Gila South RMP (Goldwater Amendment). The Goldwater Amendment also prescribes reclamation of military use areas along El Camino del Diablo when and if present training areas are identified as non-essential to current or future military training sessions.

To some extent, DoD has focused resource management attention on these areas. For example, relatively extensive cultural resource survey has been conducted within the Tinajas Altas ACEC and studies of dune endemic plants and the distribution of invasive species have occurred in the Mohawk Mountains and Sand Dunes ACEC. With the exception of some portions of El Camino del Diablo Backcountry Byway, military use of these areas has been minimal, both prior to and following their designation per the Goldwater Amendment. Similarly, with respect to the HMA, the Marine Corps has implemented additional management measures that go beyond the management prescriptions applicable to this area for the benefit of the flat-tailed horned lizard and its habitat.

4.11.3 Existing Regulatory and Statutory Requirements and Management Plans and Actions

As has been described, the BLM's Lower Gila South RMP (Goldwater Amendment) established three ACECs, two SRMAs, one HMA, and one Backcountry Byway on the BMGR, thus continuing the legacy of recognizing the special resource values that had been initiated in the 1970s under the Arizona State Parks State Natural Areas program and also efforts to expand the Cabeza Prieta NWR. However, as natural and cultural resource management shifted from the Secretary of the Interior to the Secretaries of the Air Force and Navy on 6 November 2001, these special management designations essentially expired. Until the DoD completes the BMGR INRMP and has a signed ROD for implementing the plan, management provisions of the ACECs, SRMAs, and Backcountry Byway will remain unchanged.

Current management of these areas is limited to the management prescriptions contained in the Goldwater Amendment, as outlined in Section 4.11.1, although many of these have never been implemented. Future management of the BLM's ACECs, SRMAs, and Backcountry Byway will be determined through this INRMP planning process. The alternative management strategies under consideration in the INRMP range from allowing the special management designations to expire to redesignating all of the areas as special natural/interest areas, which is a derivation of terms from the DoD guidance for implementation of the Sikes Act. DoD, Air Force, and Marine Corps guidance applicable to special/natural interest areas as they have been termed for the purposes of this EIS follow.

Like the ACECs, SRMAs, and Backcountry Byway, BLM designated an HMA for the flat-tailed horned lizard with the Goldwater Amendment. However, unlike these other areas, there are other planning and regulatory factors influencing the use and management of this area. Although first designated in the Goldwater Amendment, the boundaries and management prescriptions for this HMA was later superseded by the 1997 Flat-tailed Horned Lizard Management Strategy and interagency conservation agreement. This strategy and conservation agreement designated three other HMAs in Arizona and California, and also changed the boundaries of the BLM-designated HMA to extend west of the BMGR boundary. The conservation agreement and strategy was a primary reason for the withdrawal of the proposed listing of the flat-tailed horned lizard. Management prescriptions contained therein are more general in nature (e.g., continue monitoring of lizard populations and new surface disturbance; limit surface-disturbing projects within the HMA to one percent of the HMA area over the first five years; support continued flat-tailed horned lizard monitoring and research; mitigate surface disturbing activities in lizard habitat) as they apply to all of the HMA. These management prescriptions may change in response to a recent lawsuit that alleges, in part, that the agencies are not implementing the conservation agreement and resulted in the lizard again being proposed for listing (a decision is expected in December 2002). Furthermore, Marine Corps actions within the HMA are influenced by the discretionary conservation measures and the terms and conditions of USFWS Biological Opinions (see Section 4.7.3.2 for more detail). While development has occurred and affected the lizard in other areas, the BMGR portion of the lizards' range is considered the most protected and most important U.S. habitat for the species (Hall and others 2001).

DoD Instruction 4715.3, Environmental Conservation, Section 6.2.5

This DoD Instruction, which is for the implementation of the Sikes Act and other environmental conservation law, defines Special Natural Areas as "Areas on DoD installations that contain natural resources that warrant special conservation efforts, after appropriate study and coordination, may be designated as special natural areas. The integrated natural resources management plan for the installation shall address special management provisions necessary for the protection of each area. Special natural areas include botanical areas, ecological reserve

areas, geological areas, natural resources areas, riparian areas, scenic areas, zoological areas, 'watchable wildlife' areas, and traditional cultural places having officially recognized special qualities or attributes."

Air Force Instruction 32-7064, Integrated Natural Resources Management, Section 10.2.1

This Air Force Instruction, which implements the above DoD Instruction, provides guidance for outdoor recreation management planning in INRMPs. Lands suitable for outdoor recreation are classified based on outdoor recreation potential and ecosystem sustainability as follows:

- Class I areas (general outdoor recreation areas) are suitable for intensive recreational activities such as camping, winter sports, and water sports.

- Class II areas (natural environmental areas) can support dispersed recreational activities such as hunting, fishing, birding, hiking, sightseeing, jogging, climbing, and riding.

- Class III areas (special interest areas) contain valuable archeological, botanical, ecological, geological, historic, zoological, scenic, or other features that require protection.

The first of these classes does not apply to the BMGR, the second applies to the areas of the BMGR that are open to general public access, and the third similarly applies to areas that would meet the definition of "special natural areas" per DoD Instruction 4715.3.

Section 10.5 of AFI 32-7064 adds that "[p]ortions of installation real property that have significant ecological, biological, scenic, or educational value may be set aside for conservation of those resources, where consistent with the military mission. Such areas shall be reassessed if the military needs of the installation change, … Areas on [Air Force] installations that contain natural resources that warrant special conservation efforts may, after appropriate study and coordination, be designated as special natural areas." However, a special natural area designation would not preclude some limited military activities within the designated areas.

Marine Corps Order P5090.2A, Environmental Compliance and Protection Manual, Chapter 11, Section 11302

This guidance document applies to the Marine Corps and similarly includes a provision that states the commanding officer of a Marine Corps installation is to "Ensure the preparation of an integrated natural resources management plan to include the designation and special management provisions for special natural areas and systematically apply the conservation practices set forth in the plan."

4.11.4 Information Not Currently Available to Support Special Management Area Management

No data or information needs pertaining to the management of previously designated ACECs, SRMA, Backcountry Byway, or the HMA were identified during the preparation of the affected environment section of this EIS.

4.12 OUTDOOR RECREATION

As evident from the level of attention dedicated to outdoor recreation in previous sections of this EIS, particularly the description of the proposed action and alternatives, outdoor recreation is one of the most important resource considerations for proper management of the BMGR. The value of the natural and cultural resources present in the BMGR vicinity has been recognized by the establishment of adjacent or nearby national monuments, two national wildlife refuges, several areas of designated Wilderness (see Glossary for definition), and the international biosphere reserve in Mexico.

Recreational interest and opportunities on the BMGR—arising from attractions such as dramatic scenery, unique geologic features, and diverse plant and animal life—have also long been recognized and incorporated into land management planning for the range as compatible with the military mission. Historically, recreation use of the range occurred at relatively low levels in comparison to the nearby areas such as Organ Pipe Cactus NM and Imperial Sand Dunes Recreation Area, which most recently recorded approximately 324,000 and 2,257,000 annual visitors, respectively (Wellman 2001; U.S. DOI, BLM 2001c). This is exponentially more visitation than that which occurs on the BMGR. Some reasons for these low levels of use include the location of the BMGR (near other similar recreation attractions and remote from major population centers), permit requirements for access, possible concerns about military operations and safety, fears from illegal activities related to UDA crossings and contraband smuggling, and the lack of any substantial surface water attractions within or near its borders. However, with the rapidly growing population in Arizona and southern California, recreation use of the BMGR has been steadily increasing in recent years. All indications are that as the population of southern Arizona increases so too will the demand for the types of recreational opportunities available on the BMGR.

4.12.1 Existing Conditions

The area potentially affected by the recreation resources of the BMGR includes the range itself and those alternative recreational opportunities within the vicinity of the range and/or within the same general travel distance from major population centers including Phoenix, Tucson, and

Yuma. These same parameters and a general region of influence of that area within 20 miles of the BMGR boundary were determined to be the region of influence in the LEIS as well. The resource setting is a complex issue affected by ecoregional recreation trends, recreational opportunities, recreational services and use supervision methods, and types and levels of use and attraction sites or areas within the BMGR and the BMGR region. The ecoregional context is discussed first in Subsection 4.12.1.1. This is followed by discussions of BMGR outdoor recreational opportunities, BMGR recreation services and use supervision, BMGR recreation use statistics, and outdoor recreation within the BMGR vicinity.

4.12.1.1 Ecoregional Context

Large numbers of local residents and tourists are attracted to the Sonoran Desert and the climate, topography, and abundant natural resources of the ecoregion provide ample opportunities for outdoor recreation. As the number of outdoor recreationists in the region and the BMGR continues to increase, the specific demands and expectations of the users become increasingly complex. Several notable trends affecting recreation demand in the BMGR region include increasing urbanized and older population, loss of access to areas traditionally used for outdoor recreation, increasing ownership of ORVs and corresponding demand for ORV recreational opportunities, expanding visitor and tourism industry, and increasing outdoor recreation participation rates in excess of population growth.

As discussed in detail in Section 4.19, the population in the BMGR region experienced rapid growth (40 percent) from the 1990 to the 2000 U.S. Census, and in July 2001, the total population of Arizona was estimated at 5.3 million (U.S. Census Bureau 2001a). Combining this population estimate with a recent Arizona State Parks study that reported that 77 percent of Arizonans consider themselves recreational trail users (Arizona State Parks 1999), it can be inferred that there are about 4 million outdoor recreationists in Arizona, not including the millions of visitors to Arizona who also recreate outdoors. The population is also increasingly urban. The 1997 Special Census of Arizona found 88 percent of people in Arizona live in an urban environment compared with 9 percent in 1890 (U.S. Census Bureau 1997). Many undeveloped areas traditionally accessed for recreation have been developed and demand for outdoor recreational opportunities in close proximity to urban areas has increased (Arizona State Parks 1999). While Arizona's population remains younger than the national average (35.3 years), the median age of Arizonans increased from an average age of 32.2 to 34.2 from the 1990 to 2000 U.S. Census. For older age population groups and those with limited mobility and/or disabilities, motorized recreational opportunity and access is especially important (Arizona State Parks 1999).

Development occurring to accommodate this population growth has resulted in the elimination of much of the open space that was traditionally used for outdoor recreation and increasing reliance on public lands to provide outdoor recreational opportunities. Access to private and public lands

is becoming increasingly difficult due to various factors including transfer of ownership, changes in land use, fee increases, and urban sprawl. In addition, some designated recreation and preservation areas have had to limit outdoor recreation access for resource protection purposes. This includes recent decisions to close motorized access to 49,300 acres of Imperial Dunes Recreation Area for protection of the federally threatened Peirson's milkvetch plant and seasonal closures of certain areas within the study area for the protection of the federally endangered Sonoran pronghorn. Arizona Trails 2000 found that loss of access to trails is one of the top three most important issues facing recreationists today, with relatively more concern expressed by motorized users than nonmotorized users (Arizona State Parks 1999).

ORV recreation use on public lands has increased substantially. Since 1977, the increased use of ORVs has out-paced Arizona's population growth. ORV use has more than doubled, while the population has increased by slightly more than 65 percent (AGFD 2002a). ORV use trends correspond to increase sales of light trucks, which include sport utility vehicles (SUVs), vans, and pickup trucks. For 20 years, sales of these vehicles have risen steadily and now make up nearly 47 percent of the U.S. light vehicle market—more than twice their market share in 1983. The SUV market share has increased by more than a factor of ten, from less than 2 percent of the overall new light vehicle market in 1975 to nearly 22 percent of the market in 2001. Over the same period, the market share for pickup trucks grew from 13 to about 17 percent (Environmental Protection Agency 2001). According to Arizona State Parks (2001), Arizona residents participate in 5.1 million user days of ORV-related recreation. Within the study area, the predominant ORV-use area is the Imperial Sand Dunes Recreation Area in California, which recorded more than 851,317 ORV-related visitor use days in FY 2000 (U.S. DOI, BLM 2001c).

Arizona's tourism industry is now estimated to contribute about $12.7 billion into the state's economy and generate more than 378,000 jobs directly and indirectly (Arizona Department of Commerce 2001a), which is about a 26 percent increase since 1998 (Arizona Department of Commerce 2001c). Popular outdoor recreation attractions in Arizona include Grand Canyon National Park plus 22 other national parks, monuments, and wildlife preserves; 67 manmade and natural lakes; skiing; 25 state historical and recreation parks; preserved ruins of ancient Indian civilizations; and year-round golf, tennis, horseback riding, and hiking facilities (Arizona Department of Commerce 2001a). In the study area, tourism is also an increasingly important economic sector, with major outdoor recreation attractions including two national wildlife refuges, two national monuments, and numerous smaller wilderness areas, state parks, and recreation sites in Arizona; various recreation sites along the Colorado River; the Imperial Sand Dunes Recreation Area in California; and a biosphere reserve in Mexico.

Overall outdoor recreation participation rates are increasing even faster than the population. A nationwide study completed in 2000, found that 78 percent of the public is participating in outdoor recreation at least once a month, an increase of 11 points in the last year alone. Further, that outdoor recreation participation has increased across all age and income categories. Of those recreation activities most representative of the recreational opportunities supported in the study

area, driving for pleasure was the most popular and most rapidly increasing activity (with a 41 percent participation rate that increased by 6 percent over the last year). Other activities growing in popularity and supported in the BMGR region are bird watching, outdoor photography, and picnicking (Roper Starch Worldwide 2000). This overall trend of increasing participation in outdoor recreation is also evident within the BMGR region. Visitation at Cabeza Prieta NWR increased by 158 percent or more than doubled over the last decade (Harp 2001 and 2002). Dramatic increases within shorter time frames have occurred in the Imperial Sand Dunes Recreation Area, where the number of visitors has more than doubled and the number of visitor use days more than tripled from 1999 and 2000 (U.S. DOI, BLM 2001c), and in Organ Pipe Cactus NM, where visitation has more than doubled from 1999 to 2001 (Wellman 2001 and 2002). Participation in hunting in AGFD game management units that include the BMGR has also increased substantially, but at a more modest rate of 27 percent over the last ten years (AGFD 1997; Zalaznik 2000, 2001, and 2002).

4.12.1.2 Outdoor Recreation within the BMGR

Recreational Opportunities

As stated in Section 2.6.1, approximately 62 percent of the BMGR is regularly restricted from recreational access (including the manned ranges, tactical ranges, and Moving Sands/Cactus West Target Complexes) because of incompatibility with the military mission. Those areas of the BMGR that comprise the remaining 38 percent of the BMGR can generally accommodate public visitation on a regular basis as long as certain necessary restrictions regarding access to local electronic instrument, training, support, or resource protection sites are observed. These areas include part of Management Unit 1, all of Management Unit 2, most of Management Unit 3, a small area of Management Unit 4, most of Management Unit 6, and a small area of Management Unit 7 (see Figure 2-4). However, these areas are also sometimes unavailable to recreational users because some special training exercises require temporary closure to recreation use for safety and security purposes. In the areas generally unavailable for recreation use, some special use recreation is allowed when compatible with the military mission (e.g., during bighorn sheep hunting season, hunter access may be granted, on a case-by-case basis, to areas normally closed to recreational access). Without exception, all BMGR recreation users are required to obtain an access permit for entry to the range.

Current opportunities for recreation on the portions of the BMGR available for outdoor recreation use include dispersed hunting, backpacking, hiking, primitive camping (camping in a remote, undeveloped area where conveniences and amenities are very limited or unavailable), picnicking, recreational shooting, photography, nature study, visiting historical/cultural sites, rockhounding, geocaching, and sightseeing. The Goldwater Amendment designated the BMGR as a limited ORV use area. Recreational driving is limited to designated or established roads as stipulated by Air Force, Marine Corps, and BLM regulations. Although off-road vehicles (four-

wheel drive vehicles such as all-terrain vehicles [ATVs], jeeps, SUVs, etc.) may be used for this type of recreational driving, they must be licensed for highway driving under Arizona laws and regulations. ORV travel is prohibited. While driving in washes large enough to accommodate a vehicle is traditional among some BMGR users, this activity has not been previously authorized under BLM, Air Force, or Marine Corps regulations and BLM law-enforcement officers have enforced restrictions on this activity in the past.

In various areas of the range, recreational opportunity and use is further characterized by the effect that military use has on the resource setting, recreational facilities, and areas of natural/cultural resource interest resulting from factors such as landscape, biological conditions, and historical sites. The following characterizes the recreational opportunity within each management unit. This is followed by a brief discussion that pertains to recreational hunting opportunities on the BMGR.

Unit-Specific Description of Recreation Setting

Management Unit 1, Yuma Desert: Only the eastern portion of this management unit is generally open to public access. This area, which includes the Tinajas Altas Mountains ACEC and portions of El Camino del Diablo, is popular among recreation users. Recreational opportunities within this management unit are based on the areas' scenic, biological, landscape, and cultural qualities. The portion of El Camino del Diablo within this management unit provides ingress-egress to the adjacent Cabeza Prieta NWR and, near the Tinajas Altas high tanks, diverges into an eastern and western route, with the western route traversing through Cipriano Pass in the Tinajas Altas Mountains and the eastern route proceeding northward through the Lechuguilla Desert. The western route alignment on the western side of the Tinajas Altas Mountains remains in fairly primitive condition. The eastern route north of Cipriano Pass, on the east side of the Gila Mountains, however, was widened and graded during the 1970s and early 1980s to support Air Force testing operations at the now retired Intercontinental Ballistic Missile Superhardened Silo Testing sites. El Camino del Diablo does not provide direct access to the Tinajas Altas high tanks; rather, while multiple roads once led from El Camino del Diablo to the foot of the high tanks, the BLM's Goldwater Amendment restricted access to one route from the north and one route from the south. The segment from the refuge boundary to the Tinajas Altas Mountains has been straightened and smoothed for use as a law enforcement drag road by the U.S. Border Patrol. Vehicle-based and self-contained camping occurs throughout this management unit, subject to visitor use rules (see Section 4.12.1.3). There are some informal hiking trails and camping spots. Hunting is also popular within this unit. Interpretive facilities have been established along El Camino del Diablo (a single sign with information about the history and use restrictions) and at Tinajas Altas Mountains ACEC (a sign with information about use restrictions and several directional signs to the tanks). Geocaching, an emerging recreational activity in which participants use GPS units to hunt for a hidden cache, is occurring in this management unit with a cache located in the vicinity of Tinaja Altas.

Management Unit 2, Lechuguilla Desert: This is the only management unit that is entirely open to general public access. This management unit also contains the greatest concentration of Marine Corps ground support areas and TACTS Range facilities, which affect the character of the recreation setting in that manmade modifications are more evident in this unit than in other management units. Popular recreation sites include the Baker Tanks and the historic Fortuna and Betty Lee mine sites. At the Baker Tanks, one of the few natural catchments on the range that holds water on a near round-year basis is located near the northern BMGR boundary southwest of the town of Tacna. There are facilities for day-use and picnicking including a pavilion with a fireplace, barbecues, and trash receptacles. Residents from Tacna and Wellton are the primary users of these facilities. The Betty Lee Mine, located on the southeastern end of the Copper Mountains, and Fortuna Mine, located on the western side of the Gila Mountains, are points of interest where historical use of the sites is evident and some facilities remain evident (e.g., the mine shaft, operational and housing structures, water storage tanks, equipment, etc.). In addition, a geocache site is hidden in the vicinity of Fortuna Mine. Traveling the eastern El Camino del Diablo is also popular; however, little of the historic character that remains in other portions of the route remains within this management unit as the road has been altered by military use. Dispersed recreational driving on established roads, camping, and hunting occur throughout the management unit, subject to visitor use rules (see Section 4.12.1.3).

Management Unit 3, Mohawk Valley: This management unit is almost entirely open to general public access, except for the northeast corner of the unit east of the Mohawk Mountains. However, this management unit is closed to public access annually from 15 March through 15 July, the fawning period for the endangered Sonoran pronghorn, in compliance with the biological opinion issued to the Marine Corps (USFWS 2001b). Recreational opportunities within this unit are primarily related to driving (although there are few roads), camping, and hunting. The Mohawk Mountains and Sand Dunes ACEC is an area of biological and scenic interest. Christmas Pass Road is a point of ingress and egress to the northwestern Cabeza Prieta NWR. Military surface use within this unit is primarily limited to scattered electronic instrumentation sites and five dispersed and infrequently used ground support areas. As recreation use within this portion of the BMGR is also relatively low, there is a sense of wildness within much of this area.

Management Unit 4, San Cristobal Valley: With the exception of permitting pass-through use of the road that loops around the southern extent of the Mohawk Dunes, which is integral with the road network from Management Unit 3, Management Unit 4 is closed to general public access. Thus, recreational opportunity within this management unit is limited to driving along this road; no camping is allowed along the segment of the road within Management Unit 4.

Management Unit 5, Crater Range: This management unit is entirely closed to general public access. Thus, there is no recreational opportunity within this management unit.

Management Unit 6, Sauceda Mountains: With the exception of small isolated areas in the northernmost portions of this management unit and the run-in lines to Manned Range 1 and Manned Range 2, this management unit is open to general public access. This management unit offers the full realm of BMGR recreational opportunities and it is a popular area for recreational driving, camping, hunting, and viewing cultural/natural resource sites of interest. Hunting and camping, in particular, are popular here. Although similar recreational opportunity exists in the publicly accessible portion of this management unit located west of State Route 85 at the base of Childs Mountain, the primary recreation use that occurs in this location is RV-based camping.

Management Unit 7, Sand Tank Mountains: With the exception of a few small parcels of land contiguous with roadways in Management Unit 6 to the south or Sonoran Desert NM to the north and the Gila Bend AFAF, this management unit is closed to general public access. Recreational opportunity within the open areas includes recreational driving, hunting, and camping. The area is very scenic and is of interest biologically as it is the only occurrence of the Sand Tank Mountains Uplands Natural Community within the BMGR. The relatively developed setting at the Gila Bend AFAF, with recreation facilities and amenities provided, offers a different recreational experience in comparison to other areas of the BMGR. This installation, which is open to recreational use by military personnel and military retirees, maintains 41 family camping spaces with water and electrical hookups; these camping spaces generally are full from October through April (Sizemore 2000). The Gila Bend AFAF also has basketball courts and a running track with fitness circuit par course stations (e.g., horizontal bar for pull-ups). Personnel deployed or employed at Gila Bend AFAF are the primary users of these facilities.

Hunting

Recreational opportunities for hunting on the BMGR corresponds with three main factors (1) areas open to general recreational use, (2) AGFD hunting regulations (permit requirements, seasons, bag limits, etc.), and (3) game species distribution. As introduced in Section 4.6.3.3, the BMGR is within the boundaries of two state game management units, 40A and 40B. Unit 40A encompasses that part of the range east of State Route 85 and additional areas outside the BMGR, while 40B lies west of State Route 85 and the majority of lands that comprise this unit are BMGR lands. Within the BMGR portion of game management unit 40A, most hunting occurs in the Sauceda Valley. Within the BMGR portion of game management unit 40B, most hunting occurs in the Lechuguilla Desert and Mohawk Valley.

Big game species include javelina, deer, and bighorn sheep. Mule deer and javelina populations generally increase from west to east across the BMGR and are probably most abundant in the eastern one third. White-tailed deer are present in limited numbers in the Sand Tank Mountains. Bighorn sheep are most likely to be found in the Mohawk Mountains, Copper Mountains, Gila Mountains north of Cipriano Pass, and the Tinajas Altas Mountains south of Cipriano Pass. Hunting seasons for these species is typically in early November and mid- to late-December for

mule deer, all of December for bighorn sheep, and January and mid-February for javelina (see Table 4-17)

Small game mammals that occur on the BMGR include the desert cottontail and black-tailed jackrabbit. The antelope jackrabbit occurs to a limited extent in the BMGR. The hunting seasons for these species is typically year-round (see Table 4-17). Game birds occurring on the BMGR are the mourning dove, white-winged dove, and Gambel's quail. Of these, the Gambel's quail is probably the most frequently hunted on the BMGR. Mourning doves occur as permanent and wintering populations while white-winged doves are known only as spring/summer residents. Timing of the white-wing dove arrival coincides with flowering of saguaro cacti, their primary food/foraging source, in early- to mid-April. White-wing doves depart for Mexico and Central America usually by early September. Hunting season is in early- to mid-September and late-November through early January for mourning dove, early- to mid-September for white-winged dove, and mid-October through mid-February for Gambel's quail (see Table 4-17).

Five species of predators—the kit fox, gray fox, coyote, bobcat, and mountain lion and five furbearer species—spotted skunk, striped skunk, hooded skunk, badger, and ringtail—occur on the BMGR. The hunting season for bobcat, fox, badger, and ringtail is typically August through March, while coyote and skunks may be hunted year-round (see Table 4-17).

4.12.1.3 BMGR Recreation Services and Use Supervision

The responsibility for the recreation management was transferred from the BLM to the DoD with the MLWA of 1999. The access permit system and rules and regulations governing recreational use are the responsibility of the Air Force and Marine Corps, but represent the legacy of BLM management and the resources management plan that the proposed INRMP will replace. Under current management authority, general rules on public lands managed by BLM are codified in 43 CFR Part 8365 and are further defined for the BMGR in the Lower Gila South RMP (Goldwater Amendment) and in the Visitor Regulations provided with the range permit application.

Access Permit System

Recreational access to the BMGR is by permit only. Permit applications and associated rules, regulations, and other information are made available to the public at the Gila Bend AFAF, Luke AFB, MCAS Yuma, BLM Field Office in Phoenix, BLM Public Lands Information Center in Phoenix, and the Cabeza Prieta NWR in Ajo.

Each person in a party 18 years or older is required to obtain an individual permit. Permits are valid July 1 through June 30. In accordance with 56 RMO Operating Instruction 1-3, all permit holders planning to enter approved areas within BMGR—East must view a visitor safety video each year as a condition for obtaining an entry permit for that portion of the range. Visitors to

BMGR—East must also call a designated Gila Bend AFAF phone number (provided when the permit is issued) prior to each trip to the BMGR. When calling in, visitors must report the permit numbers of all members of the party, total number of people and vehicles in the party, areas planned to visit, activities planned for the visit, entry and departure dates of the planned visit, and the make and model of all vehicles to be used. BMGR—East visitors are also required to notify Gila Bend AFAF, by phone or in person, when they depart the BMGR to ensure visitor safety and prevent any interruption of the military mission. Enforcement actions related to this requirement are further discussed in Section 4.14.1.

All BMGR visitors are also required to sign a "Release and Hold Harmless Agreement" form, which documents the acknowledgement of recreational visitors to possible dangers on the range, as a condition for obtaining an entry permit. The form is also used for emergency notification, return of lost property, and to track user statistics. Visitors also must adhere to the general rules of conduct and vehicle operating rules in the Visitor Regulations provided with the range permit application.

Visitors to BMGR—West are required to call a toll-free number prior to each range visit to report on the permit number, party size, number of vehicles, vehicle types and make, planned visitation areas, and entry and departure dates. BMGR—West visitors are not required to view the safety video before entering BMGR—West or to make notification of their departure from the range.

General Rules of Conduct

- **Permit:** Without exception, all BMGR recreational users are required to obtain an access permit for entry to the range, keep the entry permit on the vehicle dashboard at all times, and be prepared to present the permit upon request to personnel from the Air Force, Marine Corps, BLM, AGFD, or other law enforcement personnel. Persons without valid permits may be fined and barred from future entry.

- **Areas Off-limits to Entry:** High-hazard areas are permanently off-limits. Visitation to any military targets, target areas, battlefield simulations (combat vehicles, missile emplacements), buildings, towers, and transmitters is prohibited. Entry into off-limit areas is a permit violation.

- **Military Munitions:** Visitors must leave all munitions encountered on the BMGR alone. Visitors are instructed to treat all munitions as potentially deadly, to stay away from all of them and, by all means, to not handle them. It is illegal to collect any munitions or parts of munitions.

- **Sanitation:** All garbage must be packed out. Individual human waste should be buried well below the soil surface and at least 200 feet from water sources and camp areas. Disposal of portable toilets or holding tanks is prohibited.

- **Firewood:** Collection of firewood or vegetation of any kind is prohibited in ACECs or within 150 feet of El Camino del Diablo. Only downed, dead, and detached wood may be collected for campfires on the BMGR. Collection of firewood, cacti, or any vegetative product for removal from the BMGR is prohibited.

- **Camping:** Camping is not allowed within any of the areas that are closed to public use. Camping within ¼ mile of a water hole is prohibited. Camping longer than 14 days in a 28-day period is also prohibited. Wash bottoms and locations below steep slopes should not be used as campsites during or following rain due to flooding and rock slide hazards. For vehicle-based camping, vehicles should be pulled no more than 50 feet off the road (about two car lengths). All traces of human visitation should be removed when breaking camp (including raking vehicle tire tracks).

- **Personal Safety:** Visitors are responsible for their own safety when visiting the BMGR. They must be aware of any and all hazards from military and environmental causes and take the necessary precautions to guard against them. No person shall cause a public disturbance or create a risk to others by engaging in activities such as making unreasonable noise and creating a hazard or nuisance. Visitors must supply their own drinking water and should be prepared with a supply two-days in excess of their planned stay.

- **Abandoned Mine and Well Shafts:** Abandoned mine and well shafts are unstable, dangerous, and should be avoided. Mine shafts provide habitat for several sensitive bat species. Any intentional disturbance of these animals is a violation of state and federal law.

- **Property and Resources:** No person shall willfully deface, disturb, remove or destroy any personal property, or structures, or any scientific, cultural, archaeological or historic resource, natural object or area or plants or their parts, soil, rocks or minerals, or cave resources. Do not leave personal property unattended for longer than 10 days unless you have specific authorization.

- **Wildlife Protection:** The Sonoran pronghorn antelope and its habitat are present on the BMGR. The Sonoran pronghorn is an endangered species protected under federal and state law. These animals may not be killed, harmed, or harassed in any way. All other wildlife on the range are also protected and may not be harassed, hunted, or taken by any means unless you have obtained the applicable state licenses and permits. All state and federal game laws are enforced on the range.

- **International Border:** Crossing the U.S.-Mexico international border anywhere on the BMGR is prohibited by U.S. and Mexican Law. Due to the proximity of the border, illegal alien and drug smuggling activities may occur. Avoid any encounters with individuals suspected of these activities while on the BMGR.

- **Treasure Hunting:** Excavation or removal of antiques, archeological, or paleontological artifacts is prohibited. Use of metal detectors is not allowed due to safety concerns regarding ordnance.

- **Navigation, Roads, and Vehicles:** Maps are provided with the permit rules and regulations for informational, but not navigational purposes. Four-wheel-drive vehicles are recommended to cope with the rugged nature of the roads. Vehicles are restricted to designated routes. If a road is impassable because of flooding, mud, or a lawful closure, turn back. Do not drive off-road to circumvent such areas: cross-country and off-road travel is strictly prohibited. Driving up to 50 feet off road for parking/camping purposes is permitted. Vehicles are required to comply with the general vehicle operating rules (see below). All vehicles and operators must comply with applicable Arizona state law. All vehicles, including ATVs, that are not registered as street legal are expressly prohibited. Generally, in order to be registered as a street-legal vehicle, it must have headlights, taillights, brake lights, horn, rearview mirror, and other safety equipment. State registration with the motor vehicle department as an ATV or ORV does not meet this requirement; the ATV must meet these additional requirements as would be required to operate on a street or highway (AGFD 1999).

- **ACECs.** Off-road travel is prohibited anywhere on the BMGR, including ACECs. Because of its fragile ecosystem, the Mohawk Sand Dunes ACEC is posted as closed to all vehicular traffic and roads have been posted closed in the Tinajas Altas Mountains ACEC.

General Vehicle Operating Rules

Public ORV travel is prohibited on the entire BMGR. The use of ORVs, vehicles that are equipped for travel over unimproved roads or with four-wheel drive such as ATVs, jeeps, sport utility vehicles, etc., is limited to travel on existing roads and trails in areas where public access is allowed. Vehicles are required to comply with the following general vehicle operating rules:

- All vehicles and operators must be licensed for highway driving under Arizona laws and regulations.

- Individuals must not operate a vehicle while under the influence of alcohol or drugs or in a manner that is likely to unnecessarily damage or disturb land, wildlife, or vegetation resources.

- Driving or operating any vehicle with willful or wanton disregard for the rights or safety of other persons, or without due care, or at a speed that is greater than posted or greater than reasonable and prudent under prevailing conditions, is prohibited.

- Stopping or leaving of vehicle (except for emergencies) on any road in a manner that obstructs the movement of other vehicles is prohibited. Temporarily pulling off a roadway is to be done in the least environmentally damaging way practicable and, ideally, within a distance of a few feet of the roadway.

- The operator of a motor vehicle is prohibited from operating a motor vehicle in motion, unless the operator and each front seat passenger is restrained by a properly fastened safety belt that conforms to applicable U.S. Department of Transportation standards (except that children are to be restrained as provided by State law).

4.12.1.4 BMGR Recreation Use Statistics

Recreational use of BMGR—East primarily is tracked by Luke AFB and recreational use of BMGR—West primarily is tracked by MCAS Yuma. Due to the permit system coordinated by the agencies, Luke AFB and MCAS Yuma must collaborate with other agencies issuing permits, such as the BLM Phoenix Field Office and the Cabeza Prieta NWR, to track visitation. As the agency primarily responsible for management and enforcement of game harvest in the state, the AGFD tracks hunting activity throughout Arizona, including on the BMGR. Thus, use as recorded by Luke AFB, MCAS Yuma, and BLM permitting processes are presented first, followed by a discussion of hunter use. Based on law enforcement reports, an estimated five to ten percent of recreation use on the BMGR is non-permitted and, thus, not reflected in available recreation use statistics (U.S. DOI, BLM 2000a and 2001d; Barry 2000).

<u>Luke AFB-Issued Permits</u>

The last period for which detailed and most complete recreation use data are available for BMGR—East is federal FY 1996. During that year, there were a total of 321 permits issued and 1,257 total recreation use days recorded, including 152 permits and 500 recreation use days that occurred in Area A, a former area of the range that was not renewed with the MLWA of 1999. Of the remaining 757 recreation use days, 89 percent, or 676 use days, were reportedly for hunting (U.S. Air Force, Luke AFB 1996).

More recent data compiled for BMGR—East are available only for disparate time periods ranging from November 1999 through December 2001. The data for calendar year 2000 are considered relatively incomplete and no data have been compiled for the lowest visitation months (April through July). A total of 207 individuals were issued permits and 476 recreation use days were recorded. These available data for calendar year 2000 are shown in Table 4-27 by recreation use day by the specific location visited as recorded in the database. This includes Area A and interest sites within Area A (Javelina Mountain and Johnson Well), as well as data for areas that have recently been closed to general public use: the San Cristobal Valley and Paradise Well areas. The largest party size recorded was 13 people with six vehicles, while one party with 10 individuals had 10 vehicles (Barry 2002a).

In addition, data have recently been compiled regarding recreation activities in BMGR—East based on a volunteer survey of BMGR—East visitors. These data, compiled for 57 users over a period of about two months (December 2001 through February 2002), are also shown in Table 4-27. Recreation use activity categories are as follows: deer hunting, bighorn sheep hunting, javelina hunting, dove hunting, quail hunting, camping, bird watching, wildlife observation, sight seeing, nature photography, hiking, rockhounding, and others. Some users indicated one activity while other indicated several; the most activities recorded for a single entry was eight. Data are currently lacking for the bighorn sheep, deer, javelina, and dove hunting season because of the limited data collection period (Barry 2002b). The heaviest recreational use within BMGR—East occurs from fall to spring. Although hunting is the most popular activity, camping is also popular in concert with or independent of hunter use.

MCAS Yuma-Issued Permits

From July 1995 through June 1996, the Marine Corps issued 599 permits and recorded a total of 3,498 visitors. For July 1996 through June 1997, 848 permits were issued and the total number of visitors was recorded at 3,924. Areas frequently visited by recreational users within BMGR—West include the Baker Tanks pavilion area, Fortuna Mine, Tinajas Altas Mountains ACEC, and portions of El Camino del Diablo. Permits are valid for one year and, at that time, could be used for multiple-person parties (U.S. Air Force 1999). Detailed permit data for more recent years are not available; however it is estimated that the Marine Corps issues approximately 4,000 permits per year (Faltisco 2002c).

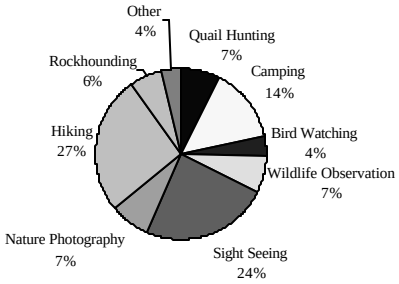
TABLE 4-27
BMGR—EAST AND BMGR—WEST RECREATION USE DATA

Luke AFB Data on Visitor Use Days in BMGR—East by Location for Most of Calendar Year 2000 [a]

Specific Location	Use Days	Percent of Total
Area B	177	37.2
Area A[b]	142	29.8
Other	45	9.5
Hat Mountain	38	8.0
Paradise Well[c]	26	5.4
Javelina Mountain[b]	17	3.6
Crater Range	14	2.9
San Cristobal Valley[c]	10	2.1
Johnson Well[a]	7	1.4
Total	**476**	**100**

Notes: a. Database is relatively incomplete and lacking data for April through July
b. These locations were formerly part of the BMGR, but were not included in the land withdrawal of the MLWA of 1999.
c. These locations were formerly open to general public access, but access to these areas is now generally restricted.

Luke AFB Data on Recreation Activities in BMGR-East for December 2001 through February 2002



MCAS Yuma Recreation Use Data for BMGR—West

Year	No. of Permits	No. of Visitors
July-June 1996	599	3,498
July 1996-June 1997	848	3,924

Sources: Barry 2002a and 2002b and U.S. Air Force 1999

BLM-Issued Permits

BMGR recreational use permits issued by the BLM Yuma and Phoenix Field Offices increased dramatically over recent years. Whereas in 1998, a total of 893 permits were issued from these offices, 2,545 permits were issued in 1999, and 3,528 permits were issued in 2000 (USFWS 2001a). This increase may be partially attributed to the changeover to the uniform permitting system. The BLM Yuma Field Office discontinued issuing permits in 2001 after land management jurisdiction for the range was transferred to the Marine Corps and Air Force. Persons in the Yuma area can still obtain permits at MCAS Yuma.

AGFD-Issued Permits

Areas on the BMGR currently open to regular hunting seasons are portions of Management Units 1, 2, 3, 6, and 7 open to general public access (see Figure 2-4). Under current policy, hunters holding bighorn sheep permits are also granted access to the portions of the Mohawk Mountains located in Management Unit 4 under a Special use Permit issued by the Air Force.

Statistics on hunter use of Game Management Units 40A and 40B compiled from 1991 through 2000 are provided in Table 4-28. These data are for both units combined, but comparatively about 60 percent of these permits are issued in Unit 40A and 40 percent are issued in Unit 40B. Data are presented in terms of hunter use days for the three big game species that may be hunted within these management units—bighorn sheep, deer, and javelina. A hunter use day represents the total number of days that each hunter licensed by the AGFD was recorded actively hunting within the management unit. For example, five hunters may receive a permit to hunt during the annual bighorn sheep hunting season. (This is a once-in-a-lifetime permit that authorizes a licensed hunter to bag one bighorn sheep within a specific management unit during a specific season, which is usually the month of December). Each day that each hunter is actively hunting is recorded as one hunter use day. If each of the five authorized hunters hunts for the average of eight days, a total of 40 hunter use days (5 hunters times 8 days) would be recorded even though the hunting season may only be 31 days long. Additionally, the hunter is often accompanied by several non-hunting spotters, adding to the number of visitor use days. Although there have been both positive and negative variation in hunter use over the last ten years, these statistics show that there has been an overall 26.8 percent total increase in hunter use days within Management Units 40A and 40B. The vast majority of hunter use is associated with deer hunting.

4.12.1.5 Outdoor Recreation in the BMGR Vicinity

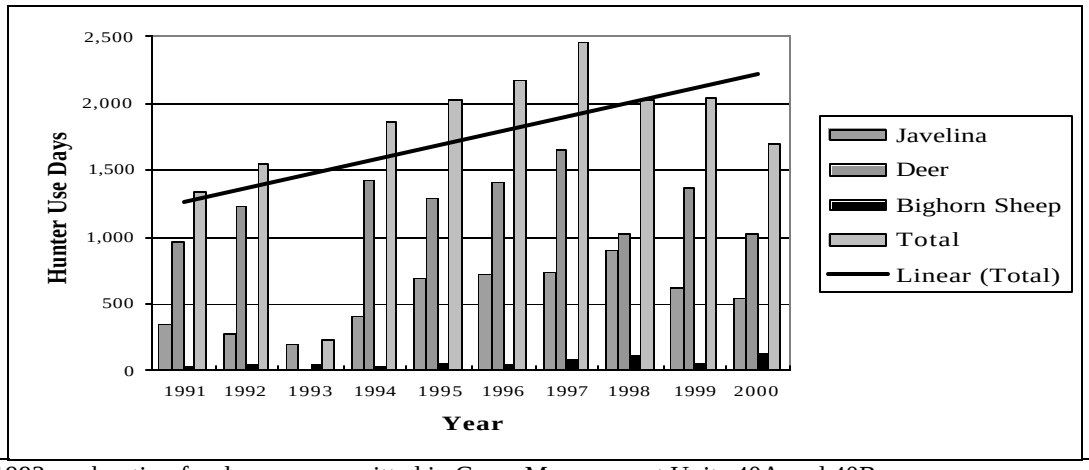
Major recreation areas in the BMGR vicinity include the following:

- two national wildlife refuges managed by the USFWS (Cabeza Prieta NWR and Kofa NWR)
- Organ Pipe Cactus NM managed by the National Park Service
- Sonoran Desert NM (established January 2001; managed by BLM)
- Imperial Sand Dunes Recreation Area/North Algodones Dunes Wilderness managed by BLM
- Reserva de la Biosfera de El Pinacate Y El Gran Desierto de Altar in Mexico managed by the Secretaria del Medio Ambiente, Recursos Naturales y Pesca (serving a similar function in Mexico to the USFWS)

TABLE 4-28
HUNTER USE DAYS FOR
GAME MANAGEMENT UNITS 40A AND 40B COMBINED

Year	Javelina	Deer	Bighorn Sheep	Total	Annual Percent of Change in Total
1991	340	968	26	1,334	N/A
1992	282	1,225	45	1,552	+16.3
1993	194	*	42	236	-84.8
1994	406	1,427	31	1,864	+689.8
1995	693	1,290	53	2,036	+9.2
1996	725	1,410	40	2,175	+6.8
1997	729	1,656	78	2,463	+13.2
1998	900	1,019	108	2,027	-17.7
1999	628	1,364	52	2,044	+0.8
2000	545	1,024	123	1,692	-17.2

Graphical Representation



*In 1993, no hunting for deer was permitted in Game Management Units 40A and 40B.
Sources: AGFD 1997 and Zalaznik 2000, 2001, and 2002

Smaller recreation areas in the area include several camping and recreation areas managed by BLM, three wildlife areas managed by AGFD, a park managed by Arizona State Parks, and rest areas along Interstate 8 managed by ADOT. Each of these outdoor recreation areas or sites are depicted on Figure 4-20 and are briefly discussed in the following pages. Other recreation sites located outside the study area, but within the map window, are shown on Figure 4-20 also, but are not discussed herein (e.g., Imperial NWR, New Water Mountains Wilderness).

Cabeza Prieta National Wildlife Refuge and Wilderness

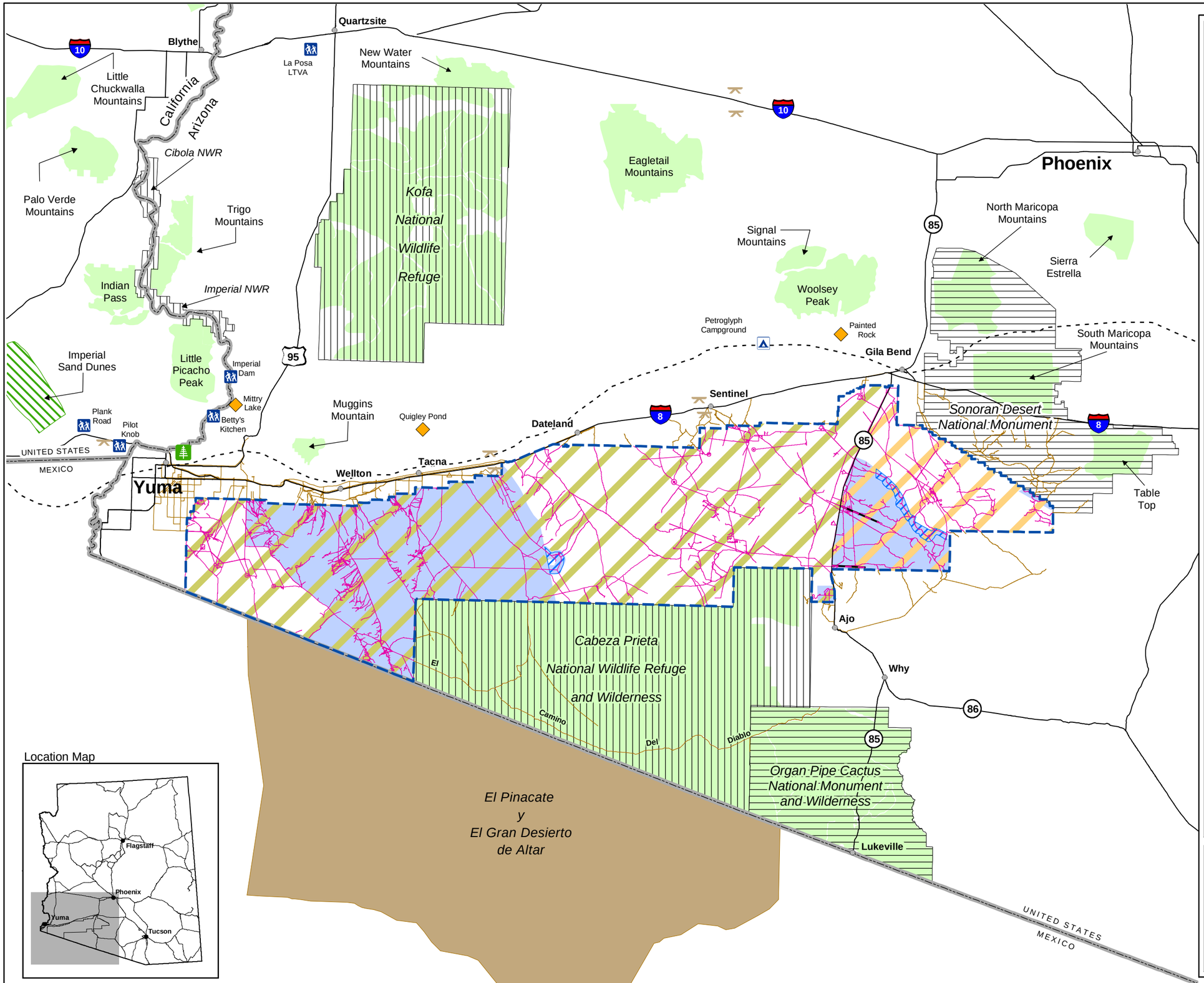
The Cabeza Prieta NWR is located south of the BMGR, where it shares 56 miles of the international border with Mexico. Established in 1939, it encompasses 860,010 acres and is the third largest national wildlife refuge in the lower 48 states. More than 90 percent of the refuge was designated as wilderness by the Arizona Desert Wilderness Act of 1990; thus, vehicle traffic is only allowed on designated public use roads (see Figure 4-20).

Recreational opportunities on the Cabeza Prieta NWR include backpacking, hiking, hunting, primitive camping, four-wheel driving (on the three unimproved public use roads in the refuge that are not included in the wilderness designation), mountain biking (on roads open to public use), wildlife observation, photography, and appreciation of wilderness solitude. A visitor center and short interpretive trail are located near the refuge office. Three primitive camping areas—Papago Well, Tule Well, and Christmas Pass—have some facilities such as tables and barbecue grills.

The potential presence of unexploded live ordnance within the Cabeza Prieta NWR poses a public safety issue for recreational visitors. Unexploded ordnance may be present within portions of the refuge as a result of training during periods dating from World War II. Records from earlier decades do not identify locations where live ordnance may have been purposely or inadvertently dropped. Although no obvious target impact areas are known within the refuge, scattered ordnance could be present either on or below the ground surface. Visitors must sign a military hold harmless agreement and are instructed not to touch ordnance, to note its location, and report it to refuge staff. Vehicles are restricted to approved roads.

Most visitors to the Cabeza Prieta NWR take advantage of the opportunity to travel a well-preserved portion of El Camino del Diablo through the refuge (Thompson-Olais 1997). The refuge portion of El Camino del Diablo starts in the east in the Growler Valley and extends west to the Lechuguilla Desert in BMGR—West, where the roadway forks and turns northwest along two parallel routes towards Wellton and Yuma. Charlie Bell well in the Growler Mountains, is also popular with refuge visitors. Unlike all other refuge roads where a four-wheel drive vehicle is required, high clearance two-wheel drive vehicles may be driven on the road to Charlie Bell (Tiller 2000).

As shown on Table 4-29, visitation data are available for the refuge for a decade. These data show that the refuge has experienced a continuing increase in visits with a total 158-percent increase over the years or an average annual increase of 15.8 percent. The biggest increases were recorded from 1992 to 1993 and 1997 to 1998, when the number of visits increased by about 42 percent, in part due to the wildflower displays. Although this trend of increasing numbers of visitors has leveled off in recent years, all indications are that, in general, visitation will continue to increase into the reasonably foreseeable future.



Legend

Recreation/Protected Management Features

- BLM Recreation Site
- Campground
- Roadside Rest Area
- State Park
- State Wildlife Areas
- Juan Bautista de Anza National Historic Trail
- BLM Recreation Area
- Wilderness Area
- National Wildlife Refuge
- National Monument
- Biosphere Reserve (Mexico)
- General Public Access with BMGR Permit
- Public Access - Day Use Only

AZ Game & Fish Dept. Management Units

- 40A
- 40B

Base Features

- BMGR Land Boundary

Roads

- Roads Inside of BMGR
- Target Lead-in Lines, No Public Use
- Roads Outside of BMGR
- Interstate / Highway / Other Highways

N

0 5 10 20 30

Scale in Miles

Recreation and Protected Management Areas in the BMGR Region

Figure 4-20

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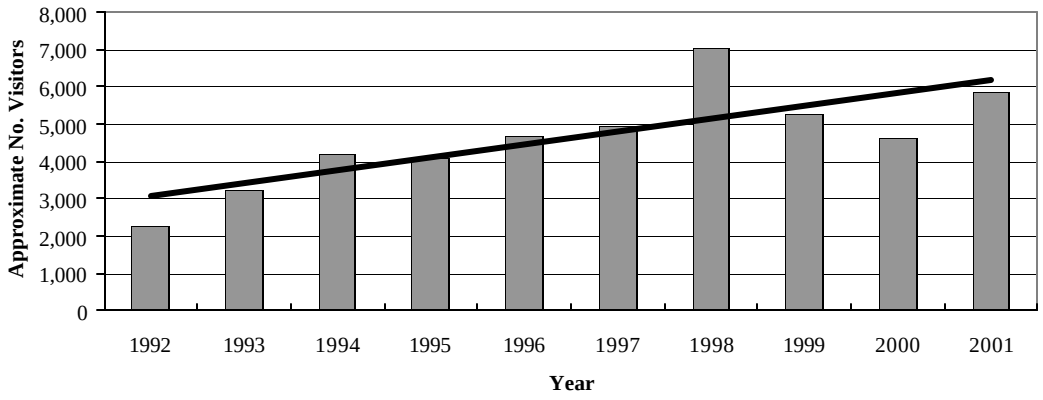
TABLE 4-29
CABEZA PRIETA NATIONAL WILDLIFE REFUGE VISITATION

YEAR	Approximate Number of Visitor Days	Percent Change
1992	2,277	N/A
1993	3,248	+42.6
1994	4,214	+29.7
1995	4,070	-3.4
1996	4,694	+15.3
1997	4,948	+5.4
1998	7,021	+41.9
1999	5,286	-24.7
2000	4,630	-12.4
2001	5,880	+27.0

GRAPHICAL REPRESENTATION



Source: Harp 2001 and 2002

Organ Pipe Cactus National Monument and Wilderness

Organ Pipe Cactus NM and Wilderness, administered by the National Park Service, is located east of the Cabeza Prieta NWR. The monument encompasses 333,689 acres of which 312,600 acres, or about 94 percent, was designated Wilderness in 1978 (see Figure 4-20). Like the Cabeza Prieta NWR, the monument shares a border with Mexico and was established in 1937. Recreational opportunities are also similar to those at the Cabeza Prieta NWR and include auto touring, backpacking, bicycling, bird watching, camping, hiking, horseback riding, nature walks, stargazing, wilderness experiences, and wildlife viewing (National Park Service 2001).

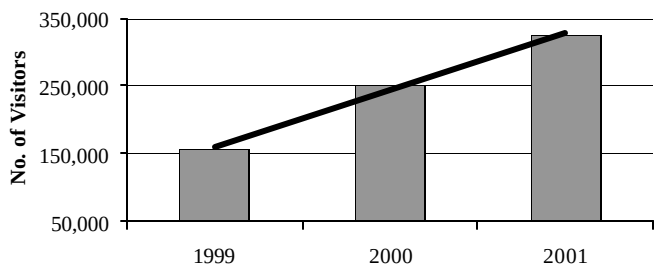
There are two designated areas for camping. Alamo Campground is a primitive campground with four, tent-only sites and a pit toilet. Twin Peaks Campground is a more developed campground with water, rest rooms, grills, tables, a dump station, and 208 campsites that accommodate RVs up to 35 feet in length (National Park Service 2001).

Historical visitor use data for Organ Pipe Cactus NM is presented in Table 4-30. Although the best data available, the information is not very useful for tracking trends because from 1996 to 1998 different statistical methods were used to estimate visitation. With the installation of some standard counters along the major use roads in the monument in 1999, however, the data for more recent years are more accurate. From 1999 to 2001, total visitation has more than doubled. From 1999 to 2000, the total number of recreational visitors increased by about 62 percent, but the total number of recreational use days decreased by about 12 percent. Although the monument has not yet calculated recreational use days for 2001, visitation totaled 324,192, a 29 percent increase from 2000. Like Cabeza Prieta NWR, the monument attributes peaks in annual visitation with years with abundant wildflowers and promotion in popular literature. Although it is not reflected in the data, 1998 was a peak year for visitation as was 2001 (Wellman 2001 and 2002).

TABLE 4-30
ORGAN PIPE CACTUS NATIONAL MONUMENT VISITATION DATA

Year	Total Number of Recreational Visitors	Total Number of Recreational Use Days
1996	399,721	100,430
1997	168,169	72,621
1998	182,126	102,137
1999	156,107	137,702
2000	252,167	122,994
2001	324,192	not calculated

Graphical Representation for 1999-2001 Visitation



Source: Wellman 2001 and 2002

Sonoran Desert National Monument

On 17 January 2001, President Clinton established the Sonoran Desert NM. The new monument encompasses approximately 486,392 acres of federal land, including 77,957 acres of former BMGR lands that were not renewed with the MLWA of 1999 (see Figure 4-20). Most of the area has been evaluated for its wilderness characteristics under FLPMA and approximately 158,975 acres within the monument—the North Maricopa Mountains, South Maricopa Mountains, and Table Top—were designated Wilderness by the Arizona Desert Wilderness Act of 1990. The monument also contains a frequently used, 20-mile trail corridor along which several important historic trails are found, including the Juan Bautista de Anza National Historic Trail, Mormon Battalion Trail, and Butterfield Overland Stage Route. In addition, the 3,520-acre Vekol Valley ACEC, previously recognized and protected for its desert grasslands habitat, is located in the southern portion of the Sonoran Desert NM (U.S. DOI, BLM 2001e).

Recreational opportunities include backpacking, hiking, primitive camping, and hunting. Motorized and mechanized vehicular travel off road is prohibited and BLM is to develop a

transportation plan that addresses road closures or travel restrictions as necessary to protect natural and cultural resources (U.S. DOI, BLM 2001e). The only data available on visitor use of the monument is the information contained in the visitor registers at the trail heads of the three wilderness areas, and those along the Juan Bautista de Anza/Mormon Battalion Historic Trail. Table Top and North Maricopa Mountains wildernesses are the most popular for recreational use. Together, they attract approximately 2,000 visitors a year predominantly associated with day use (Jamrog 1996). However, these data are entered voluntarily, and participation rates are not known. Incidental observations are that visitation increased for the few months following the establishment of the monument. When planned signs denoting the presence of the monument are placed along Interstate 8 and State Route 85, visitation is expected to increase dramatically (Dahlem 2001).

The monument includes Area A, the parcel of land that formerly comprised the northeast corner of the BMGR in the Sand Tank Mountains, but was not included in the BMGR land withdrawal per the MLWA of 1999. Recreational use is permitted within this area, but a permit is required for entry and visitors must sign a hold harmless agreement. Currently, the permit for Area A is the same as the BMGR permit.

Imperial Sand Dunes Recreation Area and North Algodones Dunes Wilderness

The Imperial Sand Dunes Recreation Area, managed by BLM's El Centro California Office, encompasses portions of a 40-mile-long dune system that extends along the eastern edge of the Imperial Valley and is the largest mass of sand dunes in California (see Figure 4-20). The dune system is divided into three areas. The northernmost area is known as Mammoth Wash. South of Mammoth Wash is the North Algodones Dunes Wilderness established by the 1994 California Desert Protection Act. The largest and most heavily used area, the Imperial Sand Dunes Recreation Area, begins at California State Route 78 and continues south just past Interstate 8.

Opportunities for recreation vary as the three areas are managed for different purposes but relate to picturesque scenery, solitude, rare plants and animals, and ORV use. The portion of the dunes south of California State Route 78 is a popular ORV recreation area. Two developed campgrounds along paved Gecko Road provide hard surface parking, vault toilets, and trash facilities. A ranger station located in this area is open weekends from October through May.

The Northern Algodones Dunes Wilderness Areas includes 32,240 acres or about 25 percent of the Algodones Dune system (USFWS 2001b). Recreational opportunities associated with Wilderness designation include hiking, photography, nature observation, experiencing solitude, and primitive camping. Because this area is closed to motorized use, the only means of access is by hiking or horseback. There are no facilities or developed campsites.

The remaining estimated 75 percent of the Algodones Dunes were, until recently, open to ORV-based recreation. However, in November 2000, BLM closed 48,000 acres of the dunes to vehicular use on an interim basis as a result of a court settlement. After an EA was completed, the interim closures were refined to five areas encompassing approximately 49,300 acres. The closures were designed to protect the Peirson's milkvetch (a federally threatened plant species protected by the Endangered Species Act) while allowing ORV recreation to continue in the most heavily used areas of the dunes. These interim restrictions will remain in place until BLM consults with the USFWS on the California Desert Conservation Area Plan (BLM 2000b and 2001d).

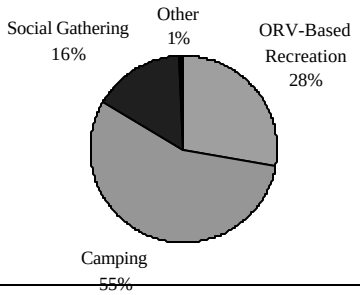
Of all recreation areas in the study area, the Imperial Sand Dunes Recreation Area is by far the most popular. Recreation use data for FY 1999 indicate that there were a total of 935,277 visitors and 1,202,118 visitor use days recorded. In just one year, the number of visitors more than doubled and the number of visitor use days more than tripled. In FY 2000, there were 2,257,283 visitors and 4,213,681 visitor use days recorded. As shown in Table 4-31, camping and ORV-based recreation account for the predominant uses of this area. Most of the use of the dunes is reportedly from Yuma, but users from Phoenix and San Diego are also common. Another trend is that visitors using this recreation area for ORV opportunities are often also boating enthusiasts who enjoy water-based recreational opportunities along the Colorado River, such as the Imperial Dam Recreation Area (Schoeck 2001).

TABLE 4-31
IMPERIAL SAND DUNES RECREATION AREA VISITATION

Year	Total No. of Visitors	Total Visitor Use Days
1999	935,277	1,202,118
2000	2,257,283	4,213,681

Year	Visitor Use Days		
	ORV-Based	Camping	Social Event
1999	672,583	481,293	0
2000	851,317	2,508,074	850,004

Average Percent Visitor Use Days by Recreation Activity



Source: U.S. DOI, BLM 2001c

Kofa National Wildlife Refuge and Wilderness

The Kofa NWR, managed by the USFWS, was also established in 1939. This refuge encompasses 665,400 acres, of which, 516,300 acres was designated Wilderness by the Arizona Desert Wilderness Act of 1990. Kofa NWR offers similar recreational opportunities to that found within the BMGR. The most popular recreation activities within the refuge include hiking, sightseeing, photography, camping, hunting, limited rockhounding, and observing nature. A half-mile foot trail is available to see Palm Canyon, the location of some of the only native palms in

Arizona. Hunting for quail, bighorn sheep, deer, cottontail, rabbit, coyote, and fox is allowed with the appropriate hunting permit obtained from AGFD and in accordance with applicable state and refuge regulations. Dispersed camping is allowed throughout the refuge (as long as it is more than one-quarter mile away from wildlife waters), but vehicle-based camping is required to be within 100 feet of the roadway (USFWS 2000a).

Estimations of visitation to the Kofa NWR show that, over the last five years, the number of visitors has been fluctuating between 50,000 and 60,000. Although the visitation estimates have been closer to 60,000 in recent years, the trend overall is fairly stabilized. Most of the visitation occurs from October through March (Varney 2001).

Reserva de la Biosfera de El Pinacate y El Gran Desierto de Altar

In Mexico, Reserva de la Biosfera de El Pinacate y El Gran Desierto de Altar was designated as a biosphere reserve in 1992 (see Figure 4-20). It is managed by Secretaria del Medio Ambiente, Recursos Naturales y Pesca (the Mexican counterpart to the USFWS). Biosphere reserves constitute an international network of protected major ecosystems that provide a baseline against which human impact on the environment can be assessed. El Pinacate y El Gran Desierto de Altar reserve consists of a core protection area that lies within a larger protective buffer area. Recreational opportunities are similar to those offered elsewhere in the region; however, the recreation experience differs dramatically. Similar geology and a landscape of cinder cones, volcanoes, and 18 massive calderas, including ten maar craters (which are as much as a mile wide and 750 feet deep), are not found elsewhere in the region. Visitation is estimated at about 5,000 per year. Visitor services are minimal, and the area is remote and undeveloped. There are two campgrounds, and permits are required for their use, but the only services offered at these sites are a few picnic tables. Dispersed camping is permitted throughout the public portions of the reserve. Most roads are not signed, maintained, or patrolled; require a four-wheel drive vehicle; and may become impassable following rains (Gauger 2002, Friends of Pronatura 1989).

Other Recreation and Preservation Areas on Public Lands

There are four additional recreation and preservation areas managed by the Arizona BLM within the study area: Vekol Valley ACEC, Woolsey Peak Wilderness, Signal Mountain Wilderness, and Muggins Mountains Wilderness. Recreational opportunities are wilderness-based, and include backpacking, hiking, and hunting. The Juan Bautista de Anza/Mormon Battalion Historic Trail, an east-west oriented trail that crosses Arizona north of the BMGR and (as previously mentioned) partially within the Sonoran Desert NM (see Figure 4-20). These areas currently receive limited recreation use (U.S. DOI, BLM 2001e).

The lower Colorado River is a popular recreation destination for people in western Arizona and southern California. Recreation use opportunities include hiking, camping, rockhounding, fishing, and boating. In addition to state, county, and private recreation sites, recreation facilities in this area consist of developed and undeveloped BLM recreation sites. Developed sites within the study area include Betty's Kitchen Wildlife Interpretive Area and Trail and the Imperial Dam Recreation Area (see Figure 4-20). The dense riverbottom vegetation and access to water at Betty's Kitchen attracts wildlife, particularly water birds, and an interpretive trail provides visitors with information about the site. Attractions of the Imperial Dam Recreation Area include cultural sites, rockhounding, watchable wildlife, unique desert scenery, hiking opportunities, fishing, boating, and swimming. Day- and multiple-day-use is support by facilities and amenities including grey water dump sites, restrooms, outdoor showers, drinking water, boat ramps, security, and entertainment (U.S. DOI, BLM 2001e).

The BLM operates the Painted Rock Petroglyph Site, located 1.5 miles south of the Gila River, about 20 miles northwest of Gila Bend (see Figure 4-20). The site provides visitors the opportunity to view an ancient archaeological site containing hundreds of prehistoric petroglyphs and historic inscriptions. Picnic tables, barbeque grills, steel fire rings, and a vault toilet are provided for picnicking and primitive camping. A campground host is on site from October through April, when the site receives the greatest visitation. At other times, the area receives little use (U.S. DOI, BLM 2001e).

Although the remaining public lands located north and east of the BMGR are relatively remote from major population centers, some dispersed recreation activity does occur in these areas. Most of the dispersed recreation is in the form of ORV use, hiking, remote camping, sightseeing, rockhounding, hunting, geocaching, and recreational mining. Public lands in the vicinity of the BMGR are classified as "limited" relative to ORV use, which means that vehicles may only be used on existing roads and trails (U.S. DOI, BLM 2001e).

State Wildlife Areas, Parks, and Other Outdoor Recreation Areas

AGFD administers the Painted Rock State Wildlife Area, located northwest of Gila Bend; Quigley Pond State Wildlife Area, located north of Tacna; and the Mittry Lake State Wildlife Area, located northeast of Yuma (see Figure 4-20). The primary purpose of these areas is for wildlife management, and the main recreation activities at these areas are wildlife observation, fishing, and hunting. Arizona State Parks maintains the Yuma Territorial Prison State Historic Park, located in Yuma (see Figure 4-20). Two rest areas with picnic and restroom facilities, maintained by ADOT, are located along Interstate 8 near Sentinel and west of Dateland, Arizona (see Figure 4-20).

4.12.2 Interrelationship Between the Military Mission and Outdoor Recreation

In accordance with the MLWA of 1999 and the Sikes Act, recreation can occur on the BMGR only to the extent that it is compatible with the needs of the military missions and associated safety and security requirements. Specifically, the MLWA of 1999 addresses public use of the BMGR through its requirement that the INRMP must provide for the:

> … proper management and protection of the natural and cultural resources of [the range], and for sustainable use by the public of such resources to the extent consistent with the military purposes [of the range]… [P.L. 106-65 Section 3031(b)(3)(E)(i)].

Similarly, the Sikes Act specifies that:

> Consistent with the use of military installations to ensure the preparedness of the Armed Forces, the Secretaries of the military departments shall carry out [the aforementioned program] to provide for—
>
> (A) the conservation and rehabilitation of natural resources on military installations;
> (B) the sustainable multipurpose use of the resources, which shall include hunting, fishing, trapping and non-consumptive uses; and
> (C) subject to safety requirements and military security, public access to the BMGR to facilitate the use [16 U.S.C. 670a (a)(3)].

In view of this statutory guidance, all recreational use opportunities are secondary to and subject to the constraints of the overriding military training mission for which the range was established. The military mission dictates that recreation can only occur in those areas where it is compatible with the military mission and corresponding safety and security requirements. As a result, 62 percent of the BMGR is closed to regular recreational access. In addition, there are other limits on recreational use opportunities that result from incompatibilities with the military mission and/or resource management requirements. For example, recreational hot air ballooning cannot occur within the restricted airspace of the range because the airspace is reserved for military flight training and other activities that are hazardous to nonparticipating aviation. Similarly, the annual closure to recreational use of those portions of the range that are within current Sonoran pronghorn habitat during the spring fawning period for this endangered species is a recently implemented example of how resource management priorities may further limit some recreational use opportunities within the BMGR.

The Air Force and Marine Corps are responsible for providing for sustainable public use of the range in a manner that (1) ensures the safety and security of all users and uses and (2) provides for conservation, rehabilitation, and protection of natural and cultural resources to the degree

necessary to sustain these resources and satisfy other resource management requirements (such as the NHPA, ARPA, etc.). The establishment and enforcement of military rules and regulations for recreation services and use supervision via the permit system is the primary means of accomplishing these goals. The requirement to obtain a permit and sign a hold harmless agreement and possible trepidation about military hazards, in turn, probably reduces the amount of recreational use that would otherwise occur on the BMGR. . Because military training once occurred within the Cabeza Prieta NWR and "Area A" within Sonoran Desert NM and unexploded ordnance may still be present, visitors to these areas must also sign a hold harmless agreement. Although no obvious target impact areas are known within these publicly accessible areas, scattered ordnance could be present either on or below the ground surface.

The recent transfer of management of non-military use of the BMGR from the BLM to the Air Force and Marine Corps with the MLWA of 1999 was accompanied by a change in the fundamental land management statutory guidance from FLPMA to the Sikes Act. FLPMA directs that resources be managed to support a balanced mix of various land uses including recreation use. By comparison, the Sikes Act provides that the range be managed to (1) support the military mission of the installation over all other elective uses, (2) conserve, rehabilitate, and protect natural and cultural resources, and (3) support sustainable multipurpose use and public access subject to safety requirements and military security.

Public visitation to any military installation provides an opportunity for the military to improve relationships with the surrounding community. For the BMGR, there is an opportunity for the public to view relatively well-preserved Sonoran Desert natural areas and the associated scenery, geology, biology, and history. Public visitation and recreation use of the BMGR is one way that the Air Force and Marine Corps can demonstrate the military's stewardship for BMGR lands in action.

In addition to the general public, members from all branches of the military use the range for outdoor recreation. The BMGR is a relatively popular site for outdoor recreation amongst those stationed at MCAS Yuma, on deployment to the Gila Bend AFAF, and military retirees visiting or residing in the BMGR region. Each BMGR military user (air or ground) is briefed on the recreational use on the BMGR and is thus made aware of the recreational opportunities present. Like the general public, military recreational users are generally restricted to the same areas accessible to the public (although some areas such as the Gila Bend AFAF are only accessible to military families and retiree). Without exception, members of the military that use the BMGR for recreation are subject to the same permit requirements and corresponding rules and regulations as other range users.

There are two fundamental ways in which the BMGR recreational setting interrelates with the military mission: (1) the withdrawal of the BMGR has had the initially unplanned effect of preserving a vast area of Sonoran Desert and (2) the predominant military use of the BMGR sets the character of recreation experience. With the relatively low levels of recreational use and the

expanse of land open to general recreational use, there are times and locations where there are miles between one range visitor and another. At the same time, the sites and sounds of humans may not be far removed as, at any time and at any location on the BMGR, military use—including low-flying military aircraft, electronically scored targets or instrument sites, and scattered military debris—may be evident or obvious.

Similarly, Border Patrol aerial and ground surveillance may also be evident or obvious. For example, the distance from the Point of the Pintas (near the point where Christmas Pass Road intersects with the Cabeza Prieta NWR northern boundary) to the nearest U.S. highway, Interstate 8, is more than 25 miles over unpaved roads. However, there is a fixed TACTS Range instrument located at the Point of the Pintas and the localized area road network includes U.S. Border Patrol drag roads.

Visitors to the BMGR are made aware of the military character of the recreational setting and that the BMGR is not managed as a primitive wilderness area where one can expect to experience solitude. This military character sets the BMGR apart from surrounding recreation and preservation areas, some of which are designated Wilderness areas and are managed in a manner where the recreational setting offers more opportunity for a primitive wilderness and solitude recreational experience. For some, the military character of the recreational setting unique to the BMGR heightens the recreational experience in that there is an opportunity to view low-flying military aircraft and/or military training areas.

4.12.3 Existing Regulatory and Statutory Requirements and Management Plans and Actions

4.12.3.1 Regulatory and Statutory Requirements

The requirements for recreation planning for the proposed INRMP are set forth by the Sikes Act and DoD, Air Force, and Marine Corps guidance for implementing the Sikes Act. The AGFD's role as manager of hunting-related recreation is set forth by Arizona law and the Sikes Act. Key elements and regulatory requirements of these authorities as they apply to outdoor recreation on the BMGR are as follows:

Sikes Act (16 U.S.C. 670 et. seq.)

- **Sec. 670a: Program for Conservation and Rehabilitation of Natural Resources on Military Installations.** Subsection (a)(3) Purposes of Program states: "Consistent with the use of military installations to ensure the preparedness of the Armed Forces, each integrated natural resources management plan…shall, to the extent appropriate and applicable, provide for (A) fish and wildlife management, land management, forest management, and fish- and wildlife-oriented recreation…."

- Subsection (a)(4) states: "Nothing in this subchapter—(A)(i) affects any provision of a Federal law governing the conservation or protection of fish and wildlife resources; or (ii) enlarges or diminishes the responsibility and authority of any State for the protection and management of fish and resident wildlife; or (B) except as specifically provided in the other provisions of this section and in section 670b of this title, authorizes the Secretary of a military department to require a Federal license or permit to hunt, fish or trap on a military installation." Subsection (b)(3) states that the INRMP, "may stipulate the issuance of special State hunting and fishing permits to individuals and require payment of nominal fees therefor, which fees shall be utilized for the protection, conservation, and management of fish and wildlife, including habitat improvement and related activities in accordance with the integrated natural resources management plan."

- **Section 670c: Public Outdoor Recreation Resources Program.** This section states, "The Secretary of Defense is also authorized to carry out a program for the development, enhancement, operation, and maintenance of public outdoor recreation resources at military installations in accordance with an integrated natural resources management plan mutually agreed upon by the Secretary of Defense and the Secretary of the Interior, in consultation with the appropriate State agency designated by the State in which the installations are located."

Military Lands Withdrawal Act of 1999 (P.L. 106-65)

Section 3031(b)(3)(E) states, "A plan under this paragraph for lands withdrawn and reserved by this section shall—(i) include provisions for proper management and protection of the natural and cultural resources of such lands, and for sustainable use by the public of such resources to the extent consistent with the military purposes for which such lands are withdrawn and reserved…(iii) provide that any hunting, fishing, and trapping on such lands be conducted in accordance with the provisions of section 2671 of title 10, U.S.C."

The referenced section, 10 U.S.C. 2671, states at (a)(2) that facilities under the jurisdiction of any military department "require that an appropriate license for hunting, fishing, or trapping on that installation or facility be obtained…"

DoD Instruction 4715.3, Environmental Conservation

- Section 4.1.4 reasserts that, "The principal purpose of DoD lands and waters is to support mission-related activities. Those lands and waters shall be made available to the public for educational or recreational use of natural and cultural resources when such access is

compatible with military mission activities, ecosystem sustainability, and with other considerations such as security, safety, and fiscal soundness."

- Section 6.1.10 states, "Portions of installation real property that have significant ecological, cultural, scenic, recreational, or educational value may be set aside for conservation of those resources, where such conservation is consistent with the military mission."

Arizona Game and Fish Department Rules and Regulations

AGFD is responsible for managing wildlife, administering all hunting permits, and enforcing all hunting and trapping regulations in the state of Arizona, including all lands within the BMGR.

- **Title 17 of the Arizona Revised Statutes, Game and Fish.** Directs the responsibility for maintenance and management of the State's wildlife resources to the Commission and AGFD. ARS 17-102 establishes that most wildlife in Arizona is the property of the State. ARS 17-231 establishes that through the Commission, the AGFD may establish policies and programs for the management, preservation, and harvest of wildlife; establish hunting, trapping, and fishing rules and prescribe the manner and methods which may be used in taking wildlife; enforce laws for the protection of wildlife; and develop and distribute information about wildlife and activities of the AGFD.

- **Arizona Administrative Code Rules, Title 12, Natural Resources, Chapter 4, Game and Fish Commission.** Under the authority of ARS 17-201 et. seq., establishes detailed rules for licenses and permits, taking and handling of wildlife, live wildlife, heritage grants, and wildlife areas among others.

4.12.3.2 Management Plans and Actions for the BMGR

Goldwater Amendment

As outlined in the 1990 Lower Gila South RMP Goldwater Amendment, the primary BLM recreation management objectives for the BMGR were to provide visitor services, information services, information materials, natural resource law enforcement, signs for public access and recreation, public safety, and natural and cultural resource protection. Management goals to achieve these objectives included enforcing all BMGR public access permit requirements; developing and posting warning, directional, and interpretive signs; and designating areas to be managed specifically for preservation and recreation. Management prescriptions were designed to reduce impact of recreation on the management and preservation areas (ACECs, SRMAs, El

Camino del Diablo Backcountry Byway, and the HMA). Many of the management prescriptions contained in the Goldwater Amendment were never implemented.

Management prescriptions for the three designated ACECs (Tinajas Altas Mountains, Gran Desierto Dunes, and Mohawk Mountains and Sand Dunes) included limiting vehicle use to designated roads, establishing interpretive facilities, prohibiting woodcutting and the taking of dead or downed trees, and prohibiting wood collecting within the ACECs. Three additional management prescriptions for the Tinajas Altas Mountain ACEC were to reduce multiple vehicle trails to single routes, prohibit camping within one-quarter mile of the Tinajas Altas High Tanks area, and to establish a ranger patrol of the ACEC. The boundaries of the Tinajas Altas Mountains ACEC were marked and information signs were posted in May 1997. Vehicle routes between El Camino del Diablo and Tinajas Altas were restricted to one route from the north and one route from the south. Vehicle access within one-quarter mile of Tinajas Altas was prohibited.

Although the Goldwater Amendment included some management prescriptions for the SRMAs and HMAs that could be recreation-related, public access to these areas has been limited because these areas are located adjacent to live-fire ranges. During the period in which the Goldwater Amendment was in effect, public visitation to these areas was very limited, with the exception of that portion of the Crater Range SRMA within and east of the State Route 85 corridor. The only restriction on recreation use for the two designated SRMAs was to limit vehicle use to designated roads. The portion of the Sentinel Plain Lava Flow SRMA that was not renewed with the BMGR land withdrawal continues to be managed under the provisions of the Goldwater Amendment until BLM develops new resource management planning for this area. This includes continuation of existing limited public access (U.S. DOI, BLM 2000 and 2001d).

Restrictions related to recreational use of El Camino del Diablo Backcountry Byway include prohibiting all firewood collection within 150 feet of the byway corridor, allowing only dead and downed wood to be collected from outside the corridor, and restricting vehicle-based and self-contained camping to within 50 feet of the road.

Other BLM recreation-related management actions accomplished since the Record of Decision for the Lower Gila South RMP Goldwater Amendment include the following:

- participating in the inventory, classification, and mapping of public use roads
- establishing interpretive facilities along El Camino del Diablo (a single sign with information about the history and use restrictions) and at Tinajas Altas Mountains ACEC (a sign with information about use restrictions and several directional signs to the tanks)
- cleaning up and maintaining the Baker Tanks Pavilion Area
- installing a bat-friendly steel gate at the Old Soak and Betty Lee Cistern mines

- repairing the chain-link fence surrounding the Fortuna Mine
- completing the Lechuguilla-Mohawk HMP and the draft Barry M. Goldwater East HMP
- installing information signs at all major road entries into the BMGR and along County 14th Street, which forms the northern boundary of the BMGR in this area near Yuma

4.12.3.3 Management Plans and Actions for the BMGR Vicinity

The following management plans for the BMGR vicinity are briefly mentioned here in context of recreation. Further information on these plans appears in Section 4.15, Transboundary and Domestic Perimeter Land Use.

Cabeza Prieta National Wildlife Refuge and Wilderness

A Draft Comprehensive Conservation Plan, in conjunction with a Final Programmatic EA for the Cabeza Prieta NWR, was prepared by the USFWS and a FONSI was approved in September 1998. This 1998 document details new refuge goals for wildlife and habitat management, and the management of compatible wildlife-dependent recreation. All alternatives examine recreational use and services and the preferred alternative is based on increasing compatible wildlife-dependent recreation. Upon further review of the 1998 EA and Comprehensive Conservation Plan by interested parties, it was determined that the plan needed to more thoroughly address wilderness issues and that an EIS would be prepared rather than and EA. The EIS and Comprehensive Conservation Plan (Wilderness Management Plan) is expected to be completed in early 2003 (Morgart 2001). Recreation-related management objectives for the refuge will be re-evaluated.

Organ Pipe Cactus National Monument and Wilderness

The recreation-related components of the 1997 General Management Plan and Developmental Concept Plans and EIS for the monument focused on various improvements to visitor services to enhance visitor opportunities while protecting resources and Wilderness values within the monument. Establishment of new trails and visitor interpretive and service facilities are included (National Park Service 1997).

Sonoran Desert National Monument

The BLM is in the initial stages of preparing a management plan for the monument. According to the Presidential Proclamation establishing the monument, the area will be managed by the BLM with the overriding purpose of protecting the objects and values for which the monument was established. BLM will involve concerned Native American tribes and groups, as well as the local and area communities, in developing the management plan. Recreation on other public lands in the vicinity of the BMGR administered by the BLM is managed by the Lower Gila South Resource Area and Yuma District RMPs (see Section 4.15, Transboundary and Domestic Perimeter Land Use).

Imperial Sand Dunes Recreation Area and North Algodones Dunes Wilderness

The Imperial Sand Dunes and North Algodones Dunes Wilderness are managed through the California Desert Conservation Area Plan, a FLPMA plan that covers 25 million acres of land in California (about half of which is BLM-managed lands). There are four classes of use established in this plan that represent various levels of management ranging from resource-protection based to meeting human needs. Development of mineral resources, power lines, pipelines, and use of lands for livestock grazing are addressed as well as management of ACECs and Wilderness Areas. The plan recognizes that recreation is an appropriate and major component within the California Desert Conservation Area. With visitors spending more than 20 million visitor days a year in the area, it is one of the most heavily visited recreation areas in the United States. Recreational opportunities addressed include hiking, hunting, camping, rockhounding, landsailing, sightseeing, and the use of ORVs (U.S. DOI, BLM 2002a).

Kofa National Wildlife Refuge and Wilderness

The 1997 Kofa NWR Management Plan and New Waters Wilderness Plan is the most recent management plan for the refuge. Some of the management issues at Kofa NWR include managing the bighorn sheep population; providing recreational opportunities including hiking, camping, sight seeing and observing nature; and protecting rare vegetation, including the Kofa Mountain barberry and some of the only native palm trees in Arizona.

Reserva de la Biosfera de El Pinacate y El Gran Desierto de Altar

The general management philosophy of the Management Plan for the Reserva de la Biosfera de El Pinacate y El Gran Desierto de Altar is the conservation of the environment and biodiversity of the reserve, while determining the appropriate and sustainable use of natural resources for the benefit of affected communities. The plan contains management objectives and planned actions

for plan implementation, monitoring, administration and financing, and public participation (El Instituto Nacional de Ecología 2000).

4.12.4 Information Not Currently Available to Support Outdoor Recreation Management

The current lack of some existing data or information poses potential challenges for the future management of outdoor recreation within the BMGR. This currently unavailable information was identified during the preparation of the affected environment section of this EIS. It does not constitute incomplete or unavailable information needed to conduct the environmental impact analysis presented in Chapter 5 in accordance with 40 CFR §1502.22. Although additional outdoor recreation information needs may be defined in the future, those identified in this document include:

- *Recreation Use Data.* There is no current source of recreation use data that can be used to track emerging recreational trends—such as levels of use patterns of activities (areas of the range that are frequented, sizes of parties, most frequent recreation activity).

- *Hunting Activities.* There is no current source of information that provides data on hunter effort and harvest success to provide data on harvest levels of game species that is specific to the BMGR. (The hunting information collected by AGFD is based on individual hunt units, which are not specific to the BMGR—they also encompass adjacent lands.)

- *Restricted Area Access.* There is no current source of information that tracks the extent of non-military agency activities, scientific research, educational activities, or other types of special access to areas of the BMGR that are restricted to general public recreation access.

- *Diverted Recreation Use*. There is no current source of information that tracks if, and to what extent, limitations on public recreation access in areas adjacent to the BMGR diverts outdoor recreation use to the range.

- *Cultural Resources.* There is no current source of information that quantifies the specific extent to which recreation use is affecting cultural resources.

- *Unauthorized Recreational Use*. There is no current source of information that tracks the extent of unauthorized recreational use (such as off-road driving on the dunes) and the potential effects from such use are unknown.

- *Recreational Shooting.* There is no current source of information that tracks the extent of recreational shooting as an activity on the BMGR.

4.13 PUBLIC HEALTH AND SAFETY

BMGR operations, like those at other military training installations, occur in accordance with three basic premises: (1) to protect public health and safety, (2) to minimize safety risks to military personnel, and (3) to prevent interference among training and support activities. The BMGR protects public health and safety by providing land and airspace locations where inherently hazardous warfare training activities, such as aerial gunnery and bombing as well as warplane maneuvering, can occur without placing the public at risk. The range accomplishes this basic function by excluding land-based public access and civil air travel from land and airspace areas where hazardous activities occur. In addition to military training, however, the BMGR is utilized for recreational purposes in certain areas. Thus, the inherent risks of ground-based hazards from military activities (unexploded ordnance, poor road conditions, and military traffic) as well as non-military hazards (venomous wildlife, heat-related illnesses, etc.) are unavoidable.

4.13.1 Existing Conditions

For purposes of this discussion, the area of potential concern includes only those areas where public access is allowed on the BMGR. Areas open and closed to the public are described below.

4.13.1.1 Public Visitation Access

As described in Section 4.12.2, the MLWA of 1999 and the Sikes Act support sustainable public use of the BMGR, but public visitation must be consistent with the needs of the military mission. Although 62 percent of the BMGR presents safety hazards or security concerns on a continuous basis and is therefore restricted from general public access, the remaining portion of the range can generally accommodate public visitation. This visitation is allowed on a regular basis as long as certain necessary restrictions regarding access to local electronic instrument, training, support, or resource protection sites are observed.

Because three tactical ranges, four manned ranges, and an air-to-air firing range as well as Gila Bend AFAF, AUX-6, and other training and support areas requiring security are supported on BMGR—East, approximately 87 percent of this portion of the range is restricted from general public access, as shown in Figure 2-4. The principal areas within BMGR—East available for general public access are in Management Unit 6 and a small area in the northeast corner of Management Unit 7 known as the Bender Spring Area. Nowhere else is public access allowed in BMGR—East except under special use permit. Special use permits will not be issued for general recreation purposes, but may cover activities such as Native American access for cultural reasons, bighorn sheep hunting in selected areas, or other special circumstances on a case-by-

case basis. All such access is permitted only to the extent that it is compatible with the military mission and military use schedules (see Figure 2-4).

Conversely, most of BMGR—West, 75 percent, is available for public use on a routine basis. Visitors in this area are currently restricted from all occupied Marine Corps ground support areas, the TACTS Range laser hazard area, and electronic instrument sites. The portion of BMGR—West generally restricted from public access includes Moving Sands and Cactus West target complexes, AUX-2, the Marine Corps Rifle Range, the Cannon Air Defense Complex, and other areas where potentially hazardous activities occur.

Other measures taken to protect public health and safety on the BMGR include the use of safety buffer zones, where visitation is controlled by specific entry procedures. In addition to the safety briefing and permit system, these procedures include continuous scheduling and range access control, gated and locked entry roads, perimeter fencing, and warning signs. Land uses such as mining, livestock grazing, and agriculture are excluded to further reduce danger to public health and safety.

4.13.1.2 Military Hazards

The principal safety risks that may be encountered on the BMGR result from military activities. Military hazards are primarily associated with training or training support activities at the four manned ranges, three tactical ranges, air-to-air gunnery range, and the Moving Sands and Cactus West target complexes. Public access is not authorized in these training areas.

Air-to-ground delivery of munitions occurs at the manned ranges, tactical ranges, and Moving Sands and Cactus West target complexes. Most of the air-to-ground bombs, rockets, and missiles delivered to these target complexes by aircraft are practice munitions that are inert with the exception of small signal cartridges that detonate on impact to produce a puff of smoke to indicate the location of the hit. Some live munitions are also used within the three tactical ranges, but only at five approved target locations. Signal cartridges and live munitions occasionally fail to fire on impact, and continue to be an explosive hazard to anyone that disturbs or collects the expended munitions.

During past training activities dating from World War II, ordnance may have been inadequately or purposefully dropped at locations throughout the BMGR, including areas that are now open to the public. The public is made aware of ordnance hazards when they apply for a permit to enter the range.

Potential ground safety hazards associated with the Moving Sands or Cactus West target complexes include laser training targets (Moving Sands only), radio and microwave radiation

transmissions, and ordnance delivery and contamination within target impact areas. A laser hazard danger area has been designated for Moving Sands. Public permittees that intend to enter BMGR—West are provided with a range map that depicts this area as off-limits to public visitation. The perimeter of the laser hazard area is also posted with signs warning against entry. No safety problems associated with laser use have been reported for the Moving Sands target. Radio and microwave radiation is transmitted by the instrumentation system of these targets; however, energy transmission is directed in a narrow beam and is not aimed at surface locations where it could be a hazard to recreationists. The transmitters are located within the target complexes well away from locations approved for public use.

In regard to aviation safety, both the Air Force and the Marine Corps have detailed scheduling and operating procedures to help prevent aircraft mishaps. Flight training has inherent risks of accidents. In the event of a crash, the Air Force and Marine Corps each have plans detailing crash response procedures. These plans include conducting search and rescue for the aircrew, establishing crash site security, assigning responsibility to responders, and cleaning up and restoring the crash site.

4.13.1.3 Road Hazards

Almost all roads on the BMGR are unpaved and many are seldom or never maintained. A four-wheel drive vehicle is usually necessary for travel on the range and there are no available comprehensive, accurate maps of public use roads on the range. There are few road signs and no other developed navigational aids on the range to assist those who are unfamiliar with the area. Driving on the BMGR is most hazardous after rain, when muddy conditions make many roads impassable, or in very dry conditions, when dust can obscure visibility. Some roads have developed deep ruts. Vehicle tires can fall into these ruts and cause the body of the vehicle to become suspended in the intervening high ground. While infrequent, vehicle collisions caused by dust-obscured visibility have led to fatalities on the BMGR.

Although not directly related to the military mission, the following hazards also pose an ever-present risk to public health and safety when visiting the BMGR:

4.13.1.4 Environmental Hazards

Environmental conditions on the range that could present serious hazards to visitors include rugged terrain, remoteness, extreme temperatures, intense sunlight, lack of drinking water, flash floods, abandoned mines and wells, and venomous wildlife.

The mountainous terrain within the BMGR is basically impassable to vehicles and can be hazardous to hikers or climbers. If recreation users are not properly prepared, they can expose themselves to a variety of hazards associated with the terrain such as rock slides and falls. Most of the heavily used ground areas on the range are more than an hour's travel time by vehicle to the nearest hospital or medical care center.

Temperatures in the hottest part of the summer can exceed 120° F (degrees Fahrenheit) during the day and remain in the 90s during the night. A 20 to 30 degree day to night fluctuation in temperature is typical. In the winter, temperatures can drop below freezing. The intense sunlight through the late spring, summer, and early fall can redden unprotected skin in just 30 minutes and a few hours of exposure can cause severe burns. All degrees of sunburn increase a person's vulnerability to dehydration and heat exhaustion. There are no sources of potable water on the BMGR. All range visitors must bring their own water. One to two gallons of water per day are needed to maintain a normal level of hydration when exposed to temperatures exceeding 90°F and more is necessary with physical exertion. Lack of adequate fluid intake can quickly lead to life-threatening heatstroke and heat exhaustion.

During the monsoon season (typically late June to mid September), severe thunderstorms can cause flash flooding on the BMGR resulting in hazardous conditions. Winter storms can also cause flooding. Danger can be avoided if people and their vehicles stay clear of major drainages during flash flood conditions and do not attempt to cross swift moving water.

Abandoned mines and wells scattered throughout the BMGR are typically located on deep alluvial desert plains, including areas accessible to the public. The remnants of some of these wells remain as unstable, partially collapsed, vertical shafts. The Air Force, Marine Corps, and BLM have taken precautions to protect the public from the potentially dangerous conditions at these sites, and to restrict activities away from these sites. Some of the mines are posted with signs that warn of the dangers of abandoned and inactive mines such as hidden deep shafts, cave-ins of loose rock or decayed timbers, unsafe or broken ladders, bad air and poisonous gasses, discarded explosives, poisonous snakes, and flooded tunnels. A few of the more hazardous mines have been fenced or gated to discourage or prevent unauthorized human entry and to protect sensitive bat habitat. A list of abandoned mines is provided in Section 4.2 Earth Resources, Table 4-3.

There are several venomous reptiles and arthropods (including insects and spiders) on the BMGR. Rattlesnakes, scorpions, spiders, bees, and cone-nosed bugs are the most likely venomous wildlife hazards on the BMGR.

4.13.1.5 International Boundary Issues

The southern boundary of the BMGR shares approximately 37 miles of the international border between the United States and Mexico. While prohibited by U.S. and Mexican federal law, UDAs and contraband smugglers routinely cross the border and pass through the BMGR. The Border Patrol is responsible for preventing UDAs from entering the United States and apprehending aliens who have already entered the United States illegally. The Border Patrol made about 8,704 UDA apprehensions on the BMGR (1,194 in the Tucson Sector and 7,510 in the Yuma Sector) during FY 2001 and 11,202 UDA apprehensions in FY 2000 (Moore 2002a, Payne 2002b). Southwest border apprehensions in general have been decreasing on a seasonally adjusted basis since February 2000. Seasonally adjusted apprehensions decreased 38 percent in the 19 months between February 2000 and August 2001 and then an additional 25 percent in the three months including and following the September 11 terrorist attack (Immigration and Naturalization Service 2002).

Activities involving the smuggling of drugs and other contraband also occur on the BMGR, although it is less common than in other more populated border areas (Mercado 1997). In FY 2000, the Yuma Sector reported one narcotics seizure and the Tucson Sector reported two narcotics seizures (Moore 2001, Colburn 2001b).

Smugglers and UDAs are vulnerable to hazards on the BMGR because they are unprepared and they are more likely to travel through the most dangerous portions of the range to avoid apprehension.

Recently, the Border Patrol has installed 14 emergency beacon stations (panic buttons) on the BMGR and nearby lands. The stations are comprised of a 30-foot pole illuminated with a beacon. The poles are mounted on a cement block that is approximately five feet-square and three to four feet high (Moser 2001).

While UDAs and smugglers generally avoid encounters with recreationists, there is some potential risk of danger to recreationists if they are perceived to accommodate an apprehension.

4.13.2 Interrelationship Between the Military Mission and Public Health and Safety

The MLWA of 1999 addresses public access and access restrictions in Section 3031(b)(2), which states:

(A) If the Secretary of the Navy or the Secretary of the Air Force determines that military operations, public safety, or national security require the closure to the public of any road, trail, or other portion of lands withdrawn and reserved by this

section, the Secretary of the Navy or the Secretary of the Air Force may take such action as the Secretary of the Navy or the Secretary of the Air Force determines necessary or desirable to effect and maintain such closure.

(B) Any closure under this paragraph shall be limited to the minimum areas and periods that the Secretary of the Navy or the Secretary of the Air Force determines are required for the purposes specified in subparagraph (A).

(C) Before any non-emergency closure under this paragraph not specified in the integrated natural resources management plan required by paragraph (3), the Secretary of the Navy or the Secretary of the Air Force shall consult with the Secretary of the Interior and, where such closure may affect tribal lands, treaty rights, or sacred sites, the Secretary of the Navy or the Secretary of the Air Force shall consult, at the earliest practicable time, with affected Indian tribes.

(D) Immediately before and during any closure under this paragraph, the Secretary of the Navy or the Secretary of the Air Force shall post appropriate warning notices and take other steps, as necessary, to notify the public of such closure.

Many of the activities associated with military training on the BMGR may be hazardous, particularly to nonparticipants. Nonparticipants are vulnerable because they have no knowledge of the scheduling of hazardous activities or the real-time character, locations, or timing of imminent hazardous events. Further, there is no means by which nonparticipants who enter restricted areas can receive real-time warnings of imminent hazardous events. Consequently, the public must be restricted from those areas of the range where their safety may be compromised. The exclusion of the public from these areas, such as weapons ranges or laser hazard locations, is also necessary to avoid interference with the timely conduct of the military mission and to maintain certain range security requirements.

Even in the event that persons trespassing in restricted areas of the BMGR suffered no harm from military operations, their presence may nevertheless cause costly disruptions of ongoing military training or support activities. As noted elsewhere in this EIS, the BMGR is heavily scheduled throughout the year to support military training, and range support activities—such as EOD work—is tightly scheduled during the infrequent breaks between training periods. There is no choice, however, but to suspend training or support activities once unauthorized persons are detected within an active restricted area of the range. Training and support activities cannot be resumed until the trespassers have been safely removed from the affected restricted area.

As provided by Section 3031(b)(2)(B) of the MLWA of 1999, the areas of the BMGR that are to be restricted from public access are to be limited to the minimum areas and periods necessary to maintain safety and security. Although public access is provided to areas of the BMGR where

there is a reasonably low level of risk to public health and safety, an accident or other safety incident within these areas could nevertheless result in short-term disruptions of military training. Necessary emergency responses and investigations that would likely follow an accident or other safety incident could also require temporary suspensions or relocations of military activities until the immediate response or investigation is complete.

The BMGR visitor permit system helps to inform the public of the access restrictions as well as the risks involved with visiting the range. The most likely health and safety risks are identified on the permit and no one is allowed to enter the publicly accessible areas of the range until they have signed a hold harmless agreement acknowledging that they understand the potential safety risks and agree to abide by established rules and requirements.

4.13.3 Existing Regulatory and Statutory Requirements and Management Plans and Actions

4.13.3.1 Regulatory and Statutory Requirements

Luke AFB Supplement 1 to AFI 13-212 Volume 1

The purpose of Luke AFB Supplement 1 to AFI 13-212 Volume 1, dated 1 June 2000, is to provide information and procedures for all units operating on BMGR—East. Although this instruction primarily details military operations protocol, certain security measures that have been created with public health and safety in mind are also included. Those mentioned include: (1) the Release and Hold Harmless Agreement created to provide civilians knowledge of possible dangers while accessing the BMGR, and (2) the protocol in place for the issuance of recreational applications for permits to BMGR—East.

Marine Corps Air Station Yuma, Station Order 3710.6H

Marine Corps Air Station Yuma Station Order 3710.6H, dated 31 March 1995, provides "...pertinent information relative to scheduling, prioritization, location, description, type, operations, and ordnance compatibility of the restricted areas and MOA/ATCAA scheduled by the Commanding Officer, MCAS Yuma." Like Luke AFB Supplement 1 to AFI 13-212 VI, the Marine Corps order includes the Release and Hold Harmless Agreement for R-2301W that educates civilians of inherent risks associated with visiting the BMGR.

Education Program

As mentioned in the sections above, the Air Force and the Marine Corps inform BMGR recreationists about health and safety risk through their respective permitting programs. In order to access the range, civilians must accept knowledge of the risks. Those civilians accessing the Cabeza Prieta NWR for recreation are also informed of the inherent safety risks in this area through USFWS's similar permit system.

4.13.3.2 Fences and Signs

Gates, signs, and fences are important features to deter unencumbered access to live-fire training areas that pose a risk to public health and safety. Signs must be accompanied with adequate barriers to prevent access into tactical range areas. Table 4-32 identifies areas where fence improvements are most needed.

TABLE 4-32
FENCING SITES OF CONCERN ON THE BMGR

Site Name	Issue of Concern
Ajo Air Force Station	At least two dirt roads enter the Ajo Air Force Station from the south and lack markers showing the boundary of the area.
State Route 85 Corridor	Large portal signs at many gates on the west side of State Route 85 could be misleading because un-escorted public access to the manned and tactical ranges is not permitted. The public is able to open gates leading into Area B.
Area B/South Boundary	The southern boundary of Area B/East TAC shares 38.5 miles of boundary with BLM and Tohono O'odham Nation lands. This boundary is not currently fenced and is posted only at a few places where roads cross the boundary. As a result, control and enforcement of access restrictions is problematic and there are periodic incursions by livestock and burros from adjacent lands. There are six access points in this area that warrant attention.
Area B/East TAC Boundary	There are four access points from Area B into East TAC/Range 3. Each of these areas currently has a warning sign, but no barrier to prevent people from entering the ranges.
East TAC/Area A Access Points	Due to the relinquishment of Area A to the BLM and its inclusion in the Sonoran Desert NM, the boundary of the range needs to be redefined. While the Paradise Well area has been used for recreational purposes in the past, it is officially within the East TAC Range and is now closed to recreational access. One of the major attractions in the area is Bender Spring, which is open to public visitation with a range permit.
Sonoran Desert NM/East TAC Boundary Area	The primary road accessing the BMGR and Sonoran Desert NM from the north leads into the town of Gila Bend and currently provides unencumbered access to East TAC.
Area C/Paloma Ranch, North Boundary	The existing fence (4.2 miles) along the western boundary of Area C (encompassing Gila Bend AFAF and extending to the west of State Route 85 about 10 miles) is in disrepair because the posts supporting the fence are primarily wooden and are rotted. The northern boundary of Area C is not fenced or posted.

TABLE 4-32
FENCING SITES OF CONCERN ON THE BMGR

Site Name	Issue of Concern
Range 4/Sentinel/North TAC area	From the boundary of Area C, west along the northern range boundary and across the new range boundary at Sentinel Plain, there is currently no fencing or posting. From the gate at the road accessing North TAC, west to the town of Dateland, there is a fence along at least some part of this boundary (15 miles) where the condition of the fence needs to be assessed. There are also several points along this boundary where old roads afford access to North TAC; these access points need to be investigated.
The San Cristobal Valley	From the town of Dateland, west to the Mohawk Mountains, the range boundary is not fenced or posted. Two major access points, one south of Dateland and one at Stoval Auxiliary Airfield, provide access to the Air-to-Air Range. Both of these access points need to be gated and posted with portal signs. At the pass between the northern and southern portions of the Mohawk Mountains, there is access to the Air-to-Air Range from the west that needs to be posted.
Source: Barry 2001b.	

In addition to portal signs and posting the external boundary of the range with warning signs, signs are needed on the interior of the range for a variety of reasons. Signs to restrict camping are needed along the route that parallels the East TAC boundary in Area B due to the potential for vehicles in this area to be mistaken for targets. In addition, all intersections of roads open for use need to be posted with markers bearing the intersection number. Visitors are not currently able to locate their geographical position due to a lack of numbering at intersections.

4.13.3.3 Search and Rescue Services

There are no public search and rescue services specifically assigned to the BMGR. Public range access and entry procedures, as described in Section 4.12 Outdoor Recreation, require persons to report the date they intend to enter and exit the range and are designed to alert the Air Force and Marine Corps to possible search and rescue situations. If search and rescue services for range visitors are deemed necessary, agencies either provide the service internally or request the assistance of other agencies such as the U.S. Border Patrol, U.S. Customs Service, NPS, and/or local sheriff's departments.

The U.S. Border Patrol conducts daily flights over the Yuma Sector of the BMGR to locate UDAs. During these flights they sometimes locate people in trouble and render assistance or perform rescues. In FY 2000, the Border Patrol performed 59 rescues in the Yuma Sector of the BMGR (Payne 2001a). The Tucson Sector does not do aerial surveys on a regular basis, but it is available for tracking aliens as well as for search and rescue. The U.S. Customs Service and the NPS have also provided assistance in past search and rescue operations on the BMGR (Daniels 1997).

4.13.3.4 Mine Sites of Concern

The Arizona State Mining Code (ARS, Title 27, Section 27-318, Article A) states that failure to cover, fence, fill or otherwise secure and post warning signs at an inactive mining shaft, portal, pit, or other excavation that is dangerous to persons legally on the premises is a class 2 misdemeanor. The State Mine Inspectors Office is responsible for administering the provisions of the Surface Mining Control and Reclamation Act (30 U.S.C. 1231-1243) and is responsible for improving safety conditions in and around active and abandoned mining operations.

Known abandoned mines within the BMGR are listed in Section 4.2, Table 4-3. While known mines have been posted, fenced, or gated, there remains a high potential for unknown mines or other deep vertical shafts such as unknown wells. Overgrown areas in the vicinity of mine sites should be approached with caution in case previously unidentified shafts remain in these areas.

4.13.4 Information Not Currently Available to Support Public Health and Safety Management

The current lack of some data or information poses potential challenges for the future management of public health and safety within the BMGR. This currently unavailable information was identified during the preparation of the affected environment section of this EIS. It does not constitute incomplete or unavailable information needed to conduct the environmental impact analysis presented in Chapter 5 in accordance with 40 CFR §1502.22. Although additional public health and safety information needs may be defined in the future, those identified in this document include:

- *Unpermitted Visitation*. There is no current source of information that tracks the number of citizens that enter the BMGR without obtaining a valid permit.

- *Public Health and Safety Incidents.* There is no current source of information that tracks public health and safety incidents or emerging issues on the BMGR.

4.14 LAW ENFORCEMENT

4.14.1 Existing Conditions

Law enforcement occurring within the BMGR includes enforcement of laws pertaining to (1) the management and protection of natural and cultural resources, (2) protection of the public and property, and (3) international customs and immigration.

Natural and cultural law enforcement may be regarded as police or security operations that protect resources or apprehend those who illegally damage or use them. On the BMGR, these functions have taken the form of routine enforcement of range entry permit requirements, vehicle use regulations, and game laws, but may also include controlling trespass grazing, illegal plant collecting, poaching, vandalism/stealing of antiquities, and/or other unlawful acts.

The principal agencies currently having jurisdiction for enforcing natural and cultural resources laws within the BMGR include the Air Force, Marine Corps, USFWS, and AGFD. The authorities of the Air Force and Marine Corps to enforce federal laws related to natural and cultural resources management is supported by the MLWA of 1999 and the Sikes Act (P.L. 106-65 §3031(b)(1)(B) and 16 U.S.C. 620e-l).

Protecting the public as well as personal/government property on the BMGR from criminal activity generally has not reached a level requiring continuous law enforcement action as has been necessary at certain national and state parks, recreation areas, and forests. Obvious public safety hazards related to military training activities, desert climate, remoteness, access restrictions, and minimal facility development at the BMGR limit public visitation and may also generally deter the potential for criminal actions against people or property.

The primary responsibility on the BMGR for enforcing state statutes controlling criminal activity lies with the Maricopa, Pima, and Yuma county sheriff's departments. AGFD law enforcement personnel are state peace officers and also have the authority to enforce state statutes. AGFD law enforcement resources are focused, however, on enforcing state game laws and regulations for safe ORV and watercraft use, which is in line with the agency's overall mission. AGFD officers will enforce other state statutes when they are the first law enforcement authority to respond to criminal activity. Investigations of such activities that extend beyond the first response, however, are turned over to the law enforcement agency best equipped to complete the investigation, which is usually the county sheriff's department.

Federal criminal statutes are currently enforced on the BMGR principally by the Marine Corps, USFWS, and U.S. Border Patrol, each of which has officers with federal law enforcement credentials operating within the range. The Air Force currently provides security for BMGR—East through contract security personnel who patrol this portion of the range primarily to ensure that only authorized personnel or permitted visitors are present and that government property is

secure. Persons not authorized to be on the range or in unauthorized locations are escorted from the BMGR or may be referred to a cooperating law enforcement agency (Marine Corps, USFWS, Border Patrol, BLM, county sheriff, or AGFD) for a criminal trespass citation. Air Force security personnel also refer information/evidence of other forms of criminal activity within BMGR—East to the appropriate law enforcement agency.

Enforcement of immigration and customs laws is intended to prevent UDAs and contraband from illegally entering the United States and to apprehend aliens who have already entered the United States illegally. Because of the BMGR's proximity to the border between the United States and Mexico, many UDAs and contraband smugglers often enter the United States through the range. The U.S. Border Patrol and U.S. Customs Service respectively have the responsibility for enforcing federal immigration and customs laws. On the BMGR, the priority daily law enforcement activities associated with the international border are designed to intercept UDAs. These enforcement activities may include reconnaissance by air or ground, vehicle inspections at checkpoints, and other procedures such as using noise and motion sensors to detect illegal traffic.

4.14.1.1 Recent Range Security Jurisdiction

Prior to the transfer of land management jurisdiction from the Secretary of the Interior to the Secretaries of the Navy and Air Force on 6 November 2001 (in accordance with P.L. 106-65 §3031(a)(1) and (b)(1)), the principal law enforcement authority for public use activities occurring within the BMGR was most recently administered by the BLM. BLM rangers from the Phoenix and Yuma field offices provided law enforcement patrol services. The chief orientation of their patrol activities was on encouraging and enforcing compliance with range permit requirements and other recreation restrictions. The levels of recent BLM patrol activities within the BMGR during 2000 and 2001 are shown in Table 4-33. The various law enforcement roles of other federal, state, and local agencies were unchanged by the MLWA of 1999.

TABLE 4-33
BLM LAW ENFORCEMENT ACTIVITIES FOR FY 2000 AND 2001

Month	Patrol Time Logged (hrs)	Public Contacts	Citations Issued
2000			
February-April	199.5	216	2
May-July	217.5	124	3
August-October	194	68	0
2001			
November 2000-January 2001	131.5	49	0
February-April	125.5	205	1
May-July	133	134	0
August-October	111	48	0

Source: U.S. DOI, BLM 2000a, 2001d, 2001f.

4.14.1.2 Current Range Security Jurisdiction

U.S. Marine Corps and U.S. Air Force

The Marine Corps and Air Force became responsible for providing security within BMGR—West and BMGR—East following the transfer of surface management jurisdiction to the Secretaries of the Navy and Air Force. Security was initially provided within BMGR—West following the transfer by active duty Marine Corps security police. The Marine Corps has since employed two civilian rangers with federal law enforcement credentials to provide dedicated security services within BMGR—West. The Marine Corps is working with the USFWS to develop an MOU that would authorize Marine Corps rangers to enforce federal statutes within the Cabeza Prieta NWR and USFWS law enforcement officers would be provided with similar cooperative jurisdiction within the BMGR.

As indicated in Section 4.14.1, the Air Force is providing security within BMGR—East through a combination of contract security officers and cooperative law enforcement support provided by the USFWS, BLM, U.S. Border Patrol, U.S. Customs Service, AGFD, Arizona Department of Public Safety, and county sheriff's departments.

U.S. Customs Service and U.S. Drug Enforcement Agency

The U.S. Customs Service is primarily concerned with deterring smuggling (seizing contraband, including narcotics and illegal drugs) and investigating violations of customs and related laws. U.S. Customs Service personnel do not routinely patrol BMGR lands. They do, however, coordinate their periodic activities on the range with U.S. Border Patrol agents and other law enforcement agencies. When the U.S. Customs Service makes a contraband seizure and arrest, the case is released to the U.S. Drug Enforcement Agency. The U.S. Drug Enforcement Agency personnel work in the BMGR region when special cases warrant their presence.

U.S. Border Patrol

There are two Border Patrol jurisdictional sectors on the BMGR—the Tucson and Yuma sectors—divided by the Pima/Yuma County border. The Tucson and Yuma sectors of the Border Patrol are responsible for the entire Arizona-Mexico border and portions of the California-Mexico border (in Imperial County). The western unit, the Yuma Sector, includes BMGR lands within Yuma County. The eastern unit, the Tucson Sector, performs operations in Pima, Santa Cruz, and Cochise counties. Within the Yuma Sector, Arizona field stations are located in Wellton and Yuma. Within the Tucson Sector, the Ajo field station is located near the BMGR in Why, Arizona.

Traditional Border Patrol operations/activities include patrolling roads and off-road areas, dragging unimproved roads to facilitate the observation of foot traffic, conducting aerial reconnaissance, and inspecting vehicles at checkpoints. Ground surveillance, for the most part, is conducted along Border Patrol drag roads. Drag roads are prepared by frequently dragging several bolted-together tires over a dirt road or well-used trail to erase old footprints and vehicle tracks and provide a fresh surface in which evidence of recent (since the last dragging) illegal crossings by people or vehicles is readily apparent. Currently, the Tucson and Yuma sectors maintain six OH-6 Alpha helicopters and three fixed-wing light aircraft (two Cessnas and one Supercub Piper) that can provide assistance to any station within the two sectors. There is one established helicopter flight route within the Yuma Sector. Each morning, a helicopter flies from the Yuma station to the U.S./Mexico border, flies along the border, and returns to the station. This flight takes approximately four hours. The three fixed-wing aircraft are used for higher elevation surveillance and pilot training (Immigration and Naturalization Service 2001).

Border Patrol activities conducted within the Ajo Field Station area, including the BMGR, consist of on- and off-road patrols utilizing four-wheel drive vehicles and 4-wheelers (quads). No dragging operations are conducted from this field station and air patrol flights are usually related to specific search and rescue missions (U.S. Border Patrol 2001).

Due to the extreme temperatures that occur in southwestern Arizona from May through October, it is often necessary for the U.S. Border Patrol to conduct search and rescue missions to save UDAs who are suffering from heat-related distress. In recent years, immigration law enforcement has been greatly expanded along some areas of the border near urban centers that were historically the most extensively used crossing points. As a result, there has been a large increase in crossings of more remote areas, particularly through the Cabeza Prieta NWR and Organ Pipe Cactus NM, but also the BMGR, as documented in Section 4.13.1.

4.14.2 Interrelationship Between the Military Mission and Law Enforcement

Effective enforcement of range access regulations and prevention of potential public safety issues on the BMGR is necessary to ensure an uninterrupted military mission. BMGR law enforcement and security personnel support the military mission by monitoring and controlling the entry and conduct of visitors and by maintaining the security of equipment and ordnance on the range. Patrolling for general public safety concerns further supports military operations by helping to avert problems that may cause interruption of those operations.

Individual military training, test, and support activities are managed and conducted in a manner to prevent or minimize unnecessary adverse environmental consequences, to the extent that mission objectives can be achieved, and to avoid jeopardizing the sustainability of both the range ecosystem and its biodiversity. These management efforts to support the military mission of the

BMGR could be undermined, however, if non-military activities on the range were allowed to place either the ecological health or biodiversity of the range at risk or to elevate other environmental effects, such as air quality emissions, to levels that could trigger regulatory limitations on military activities. Law enforcement can support the military mission of the BMGR by curbing violations of the rules of conduct that govern non-military use of the range. Enforcing these rules would help to prevent non-military activities, such as toxic waste dumping or unauthorized off-road driving, that could result in aggregate environmental degradation that, in turn, could undermine the capability of the range to sustain military activities.

Successful U.S. Border Patrol and U.S. Customs Service deterrence of illegal alien traffic and contraband smuggling can also benefit military operations on the range. Deterring illegal traffic avoids the need to interrupt military use in areas such as tactical ranges to protect the safety of the trespassers. Deterring illegal and trespass traffic also prevent environmental damage that could also degrade the capability of the BMGR to support military activities.

4.14.3 Existing Regulatory and Statutory Requirements and Management Plans and Actions

The most recent resource management plan for the BMGR, the Goldwater Amendment, addresses law enforcement only in terms of BLM intensions to enforce ORV and vehicle use regulations and other rules of conduct established by the plan to govern public use of the range (U.S. DOI, BLM 1990b). These rules of conduct were incorporated in all subsequent information distributed to visitors and in the terms of permits required for public entry to the range. No other law enforcement strategies are identified in the Goldwater Amendment.

Requirements for enhanced law enforcement actions to control visitor use of the range and illegal UDA and contraband smuggling traffic emerged as increasingly important management issues during the second half of the 1990s. In response to the visitor use issue, regular patrols of the public use areas of the BMGR were initiated in 1997. The BEC formed a law enforcement working group in January 1998 to review requirements for establishing court enforceable rules of conduct, including vehicle operating rules, and to facilitate coordination among the various law enforcement agencies operating on the range. As indicated in Section 4.14.1.2, the Air Force and Marine Corps assumed the responsibility for conducting regular patrols of the BMGR on 6 November 2002 to make contact with visitors and ensure their compliance with range entry permit procedures and rules of conduct.

As also indicated in Section 4.14.1.2, the U.S. Border Patrol expanded its law enforcement activities in the late 1990s to counter the sharply increasing influx of UDA traffic entering the United States through the BMGR.

4.14.4 Information Not Currently Available to Support Law Enforcement Management

The current lack of some existing data or management information poses potential challenges for the future law enforcement within the BMGR. This currently unavailable information was identified during the preparation of the affected environment section of this EIS. It does not constitute incomplete or unavailable information needed to conduct the environmental impact analysis presented in Chapter 5 in accordance with 40 CFR §1502.22. Although additional law enforcement information needs may be defined in the future, those identified in this document include:

- *Code of Conduct Violations*. There is no current source of information that tracks the frequency with which visitors violate the code of conduct that is a provision of the BMGR entry permit.

- *Law-Enforcement Activities*. There is no common source of information that tracks current law-enforcement patrol activities, public contacts, and incidents.

4.15 TRANSBOUNDARY AND DOMESTIC PERIMETER LAND USE

4.15.1 Existing Conditions

4.15.1.1 Introduction and Regional Perspective

During the last century, urban development in the United States occurred at a rapid rate. According to the USGS, from 1970 to 1990, a national increase in population of one percent resulted in a 6 to 12 percent increase in land use. This urbanization continues to be an ongoing land use trend, especially in the Southwest. From 1900 to 1990, the population of the southwestern United States (Arizona, California, Colorado, New Mexico, Nevada, and Utah) increased by approximately 1,500 percent as compared with the entire U.S. population, which increased by 225 percent. Continued urbanization of the western United States will be a trend for the 21st century. Arizona and New Mexico are among several southwestern states that are proposing municipal urban growth boundaries to contain urban sprawl, maintain habitat continuity, and reduce the human impact on the land surface. As a result of population growth in the western United States, there has been an increase in recreational use of lands as well (USGS 2001).

Although lands surrounding the perimeter of the BMGR are mostly undeveloped, recent commercial and residential development is emerging as the population of Arizona (and subsequent development) continues to grow. Typically, the dominant land transformation is the transition of unsettled land to human settlement. Commensurate with the transition to human settlement is the development of supporting land uses, such as commercial service, industrial

waste management, public facilities, and agriculture. However, future land use is also influenced by factors that can be opportunities or constraints to development such as terrain, land use controls or zoning, protected land designations (e.g., ACEC, Wilderness, wildlife refuge, state park, etc.), and accessibility to existing utilities and transportation routes. Understanding patterns in land use surrounding the BMGR is an essential component in integrating the human element into the proposals under consideration in this EIS.

In general, the majority of off-range lands in the vicinity of the BMGR are undeveloped, consisting of open range and low, mountainous terrain. The primary land uses include agriculture, livestock grazing, and various areas designated for recreation, resource protection, or conservation. Population centers in the vicinity of the range include the larger communities of Yuma, Wellton, Gila Bend, and Ajo. Smaller communities include Roll, Tacna, Dome, Ligurta, Sentinel, and Aztec, which are all located north of the BMGR along Interstate 8.

4.15.1.2 Study Area and Data Sources

The most recent comprehensive analysis of perimeter land use available with regard to the BMGR is the *BMGR Renewal LEIS Final Perimeter Land Use Technical Report* dated 13 May 1998. Although the proposed actions under consideration in this EIS differ substantially from the proposed action in the LEIS, the land use information remains largely valid. Thus, most of the discussion in this section relies on the data collected for the purposes of the LEIS including an inventory of land status (jurisdiction), existing land uses, zoning, and planned or proposed land uses regarding adjacent lands. However, some elements—such as planned and proposed land uses—have been updated as warranted.

For this EIS, the perimeter land use study area is defined as lands within five miles of the BMGR perimeter. This five-mile buffer includes lands that are located within portions of Yuma, Maricopa, and Pima counties in Arizona and within the state of Sonora, Mexico. This is the same study area defined and analyzed in the LEIS for the renewal of the BMGR land withdrawal with two notable exceptions—(1) detailed analysis of land jurisdiction and use in Mexico was not conducted for the LEIS, and (2) the BMGR boundary has changed. For the LEIS, the potential for impacts to land jurisdiction and use in Mexico related to the renewal or non-renewal of the BMGR land withdrawal were not foreseen. Likewise, land jurisdiction and use in Mexico will not likely be affected by the actions proposed in this EIS. However, to make resource management decisions that affect the human land use element, it is important to understand land use in Mexico. To have a more fully integrated representation of the affected environment, additional efforts were made to gather land use and jurisdiction data for lands in Mexico within five miles of the 37 miles of border that BMGR—West shares with Mexico.

Land jurisdiction within the BMGR region was originally delineated for the LEIS using BLM surface management status maps, state of Arizona land ownership maps, and county and

municipal maps. In addition, land uses were inventoried using a combination of aerial photography, field survey, and coordination with government planning agencies, and Geographic Information System (GIS) analysis. For this EIS, land jurisdiction and use within Mexico was identified from two sources: Instituto Nacional de Estadistica Geographia y Informatica (INEGI) maps and Defense Mapping Agency maps.

4.15.1.3 Land Status

Land status refers to the limits of administrative or jurisdictional control maintained by the major landholders within the perimeter study area and does not necessarily represent ownership. Figure 4-21 depicts the private, state, and federal lands that are located within the perimeter land use study area. The majority of the perimeter lands are administered by the BLM, USFWS, and the Tohono O'odham Nation. Although the missions and primary functions of the various entities have previously been discussed (see Table 1-1), the following discussion specifically addresses the roles of those entities in terms of administration of the lands within the perimeter study area.

Bureau of Land Management—The BLM Phoenix Field Office administers the majority of the BLM lands within the perimeter study area. BLM lands managed by the Yuma Field Office are primarily located west of Wellton. The majority of lands managed by the Phoenix Field Office are located near Sentinel; east of Gila Bend, along Interstate 8; and in the vicinity of Ajo. The BLM also manages four parcels of adjacent land that were formerly part of the BMGR, but were not included in the land withdrawal authorized by the MLWA of 1999. These four parcels of land are commonly referred to as the Interstate 8 Vicinity, Sentinel Plain, Area A or the Sand Tank Mountains area, and Ajo Airport Area (see Section 1.4.1 and Figure 4-21). Per the MLWA of 1999, these areas will be under the joint jurisdiction of the Department of Interior (BLM) and DoD until DoD relinquishes the land and BLM accepts the parcels. An assessment for potential contamination has been conducted as one of the steps in the relinquishment process. The Secretary of the Interior (BLM) has prepared a report containing recommendations for future land use of these four areas.

Of these parcels, the future land use has been determined only for Area A or the Sand Tank Mountains area. When President Clinton designated the 486,603-acre Sonoran Desert National Monument on 17 January 2001, all 77,957 acres of the Sand Tank Mountains area as well as other adjacent lands including the BLM-managed North Maricopa Mountains, South Maricopa Mountains, and the Table Top Wilderness areas became part of this new national monument. BLM is responsible for administration and management of this new national monument (U.S. DOI, BLM 2001g). The Tohono O'odham Nation is on record as desiring to have the four parcels transferred to its ownership. Also, the Western Pima County Community Council and the Ajo District Chamber of Commerce are on record as requesting that the Ajo Airport parcel be transferred to a suitable entity for use by the citizens of Ajo. BLM's 2000 *Barry M. Goldwater Non-Renewed Parcels Study* suggests that the BLM is the most appropriate agency for future

administration of the remaining three parcels, unless Congress or future BLM land use planning determines otherwise (U.S. DOI, BLM 2000c).

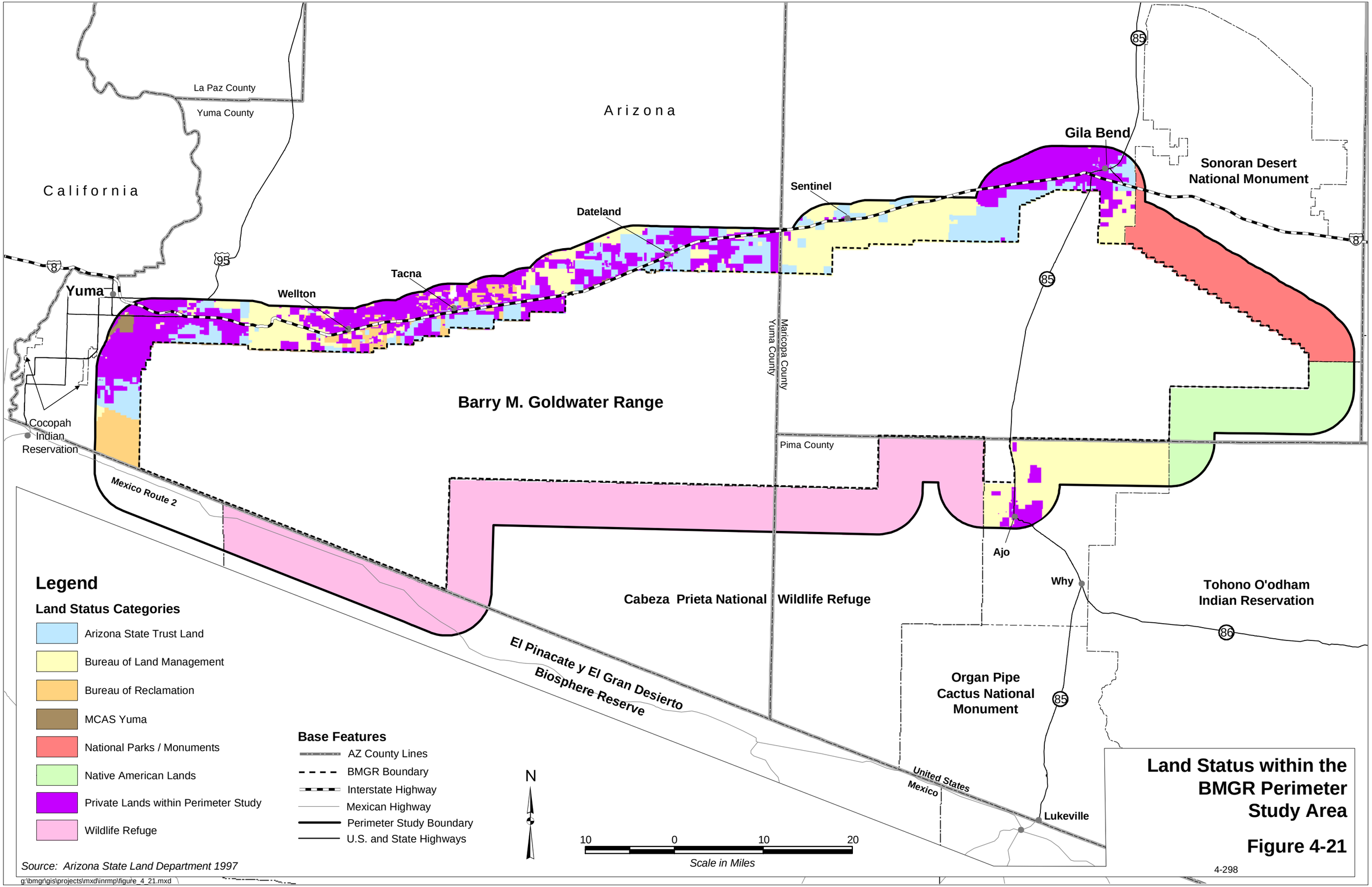
U.S. Fish and Wildlife Service—The BMGR shares about 55 miles of border with the 860,010-acre Cabeza Prieta NWR. The USFWS administers the Cabeza Prieta NWR for the conservation and development of natural wildlife and plant resources. Most of the refuge is also designated as Wilderness. Although the refuge lands are no longer part of the BMGR (through the passage of the MLWA of 1999), military aviation training continues in the restricted airspace overlying the refuge.

Bureau of Reclamation—Within the study area, BOR lands are primarily associated with the irrigated farmlands located south of Yuma and in the Wellton-Mohawk area. The area along the Gila River in the Dome and Mohawk valleys is part of the Wellton-Mohawk Division of the federal reclamation project known as the Gila Project.

Native American Lands—Native American lands within the perimeter study area are within the auspices of the Tohono O'odham Nation. This reservation land, or Tribal Trust land, is administered by the Tohono O'odham Tribal Council and political subdivisions of the Tohono O'odham Nation called districts. Three Tohono O'odham districts fall within the study area. The Hickiwan District and Sif Oidak District, which are part of the main Tohono O'odham reservation, are located southeast of the BMGR, and the San Lucy District, on the Gila Bend Indian Reservation (which is geographically separated from the main Tohono O'odham reservation), is located north of the BMGR near Gila Bend.

State Trust Lands—These lands are located throughout the northern and western portions of the study area, with the biggest blocks located near the communities of Gila Bend, Dateland, and Yuma. State Trust Lands are under the jurisdiction of the Arizona State Land Department and represent land held in trust to generate revenues for Arizona schools. Many of these State lands are leased for a variety of purposes, including agricultural production, grazing, or commercial and industrial uses.

Incorporated Areas—Incorporated communities within the range perimeter study area include Yuma, Wellton, and Gila Bend in Arizona. The City of Yuma is the largest community in the study area with a permanent population of more than 70,000. Wellton has a population of approximately 1,400 and serves as a business, service, and recreation center for surrounding agricultural areas. Gila Bend has a population of about 1,800 and primarily serves as an agricultural and highway service-oriented community.


La Paz County
Yuma County
Arizona
California
Gila Bend
Sonoran Desert
National Monument
Sentinel
Dateland
Tacna
Wellton
Yuma
Maricopa County
Yuma County
Barry M. Goldwater Range
Cocopah
Indian
Reservation
Pima County
Mexico Route 2
Ajo
Why
Tohono O'odham
Indian Reservation
Cabeza Prieta National Wildlife Refuge
El Pinacate y El Gran Desierto
Biosphere Reserve
Organ Pipe
Cactus National
Monument
United States
Mexico
Lukeville
Legend
Land Status Categories
Arizona State Trust Land
Bureau of Land Management
Bureau of Reclamation
MCAS Yuma
National Parks / Monuments
Native American Lands
Private Lands within Perimeter Study
Wildlife Refuge
Base Features
AZ County Lines
BMGR Boundary
Interstate Highway
Mexican Highway
Perimeter Study Boundary
U.S. and State Highways
N
10
0
10
20
Scale in Miles
Source: Arizona State Land Department 1997
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Land Status within the
BMGR Perimeter
Study Area
Figure 4-21
4-298

International Boundary—A 60-foot strip of land adjacent to the international boundary is reserved by Presidential Proclamations 1897 and 1907, whereby President Theodore Roosevelt withdrew these lands from all forms of appropriation. The only allowable use of these lands is for public highways. Motivations for this action included smuggling activity and political unrest in Mexico (U.S. Air Force 1986).

El Pinacate y El Gran Desierto de Altar Biosphere Reserve—Designated in 1992, El Pinacate is managed by Secretaria del Medio Ambiente, Recursos Naturales y Pesca (the Mexican counterpart to the USFWS). Biosphere reserves constitute an international network of protected examples of major ecosystems that provide a baseline against which human impact on the environment can be assessed. El Pinacate y El Gran Desierto de Altar reserve consists of a core protection area that lies within a larger protective buffer area and is contiguous with the Reserva de la Biosfera Alto Golfo de California y Delta del Rio Colorado located approximately 40 miles to the southwest, where the Colorado River delta meets the Sea of Cortez (see Figure 4-21).

Other Lands in Mexico—Most of the land in the perimeter study area within Mexico is held privately or communally through the *ejido* system (TNC and others 2000). The Mexican Constitution of 1917 created the *ejido*, incorporating both European and indigenous land-tenure institutions. The *ejido* consists of village lands communally held in a system of land tenure that combines communal ownership with individual use, and includes cultivated land, pastureland, other uncultivated lands, and the *fundo legal* (townsite). In the past, the cultivated land, in most cases, was divided into separate family holdings, which could not be sold; however, the land could be handed down to heirs. *Ejidos* currently constitute about 55 percent of Mexico's cultivated land (Encyclopedia Britannica 2000). Until the 1980s, the Mexican government fostered the growth of *ejido* and communal tenure enterprises by providing resources such as subsidized credit, technological extension, and some infrastructure improvements such as added highways. However, by the 1990s, many Mexican *ejido* members had become victims of inconsistent government policies and tough economic times. In 1992, the Mexican president reformed the Constitution, allowing *ejido* lands to be titled individually to members and sold or leased in an open market (Emanuel 2000). Today, the Mexican states are responsible for land use planning on the lands.

Private and other—includes all land in the study area that does not otherwise fall into the previous categories, including small rural communities, dispersed private lands, and lands owned by local governments. Unincorporated communities and private lands typically fall under the jurisdiction of counties; those within the perimeter study area are Yuma, Pima, and Maricopa counties. Yuma County administers unincorporated lands that are located in the vicinity of the City of Yuma and near Wellton. Maricopa County administers land near Gila Bend. Private lands located near Ajo are administered by Pima County.

4.15.1.4 Existing and Planned Land Use

Existing land uses, shown on Figure 4-22, were categorized according to the eight major categories of land use listed and briefly described in Table 4-34. Much of this land use mapping information relies on data collected for the LEIS for the renewal of the BMGR land withdrawal, which was derived from land use zoning[32] for Yuma, Maricopa, and Pima counties and for the City of Yuma and the town of Gila Bend. Updates to the land use inventory completed for the LEIS are described, but they are only reflected on Figure 4-22 when adequate mapping data were readily available.

This description of existing and proposed perimeter land use references geographically based features along the range, beginning in the westernmost portion of the study area in Yuma and continuing in a clockwise fashion along the range boundary. Land descriptions are based on naturally-occurring boundaries that are present at the Gila Mountains, Mohawk Mountains, and Sentinel Plain and continue south past Gila Bend to the Tohono O'odham Nation, Ajo, and finally, Mexico (see Figure 4-22).

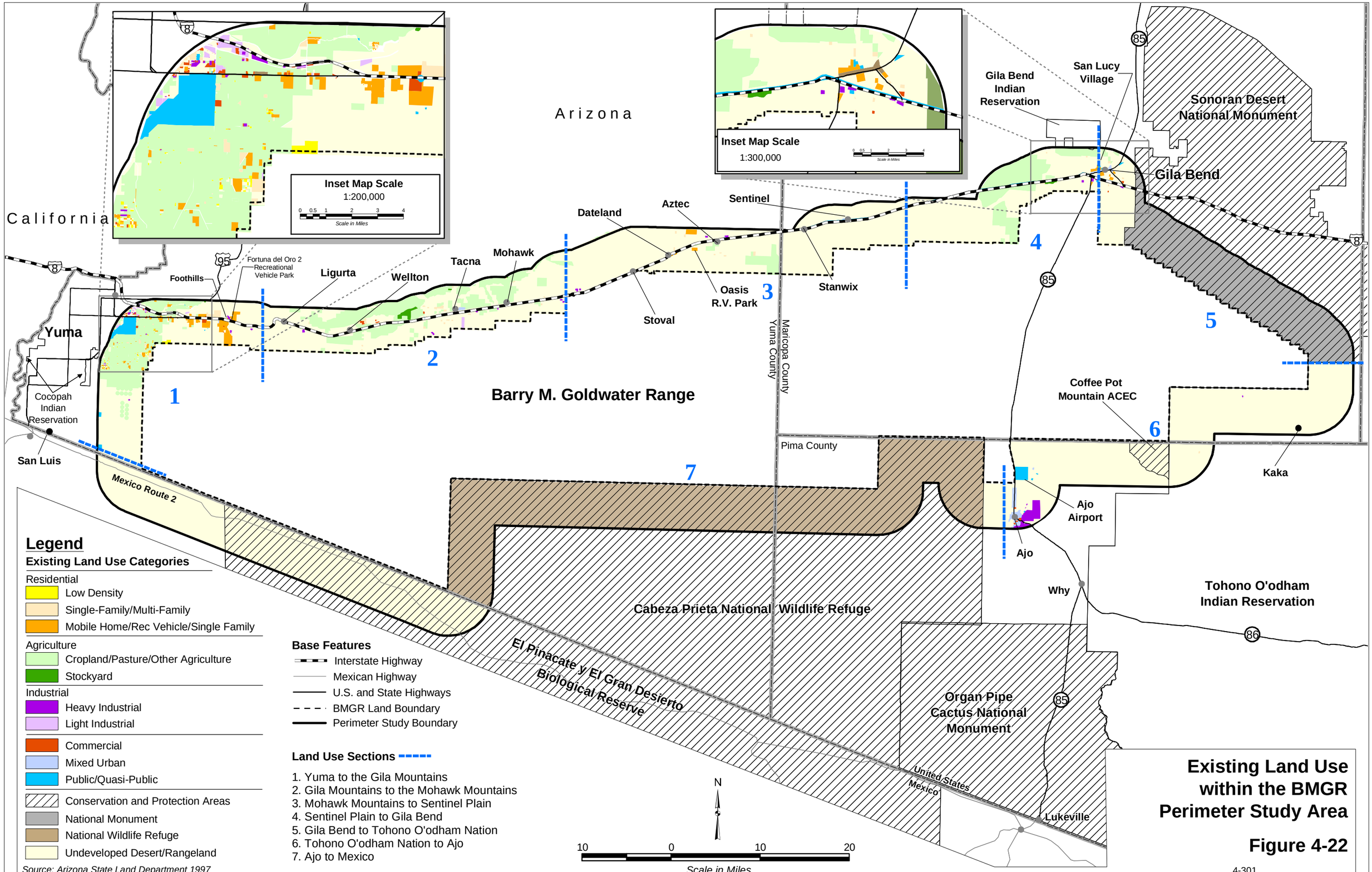
<u>Yuma to the Gila Mountains</u>

Existing Land Use

Yuma and the Foothills area are two of the larger communities that are located within this area. The City of Yuma, situated just south of where the Gila and Colorado rivers transect, is partially located within the perimeter study area and is the county seat of Yuma County. The Foothills area, located approximately 10 miles east of Yuma along Interstate 8, is a growing community that attracts winter visitors. The July 2000 population estimate for Yuma was 73,000. However, according to Yuma County Planning Department, population in the Yuma area increases to approximately 200,000 people during the winter season (starting in about January). Most of the visitors concentrate in the Foothills area (Gallagher 2001). Although population figures for 2000 were not available for Foothills, 1990 U.S. Census Bureau figures estimated the population to be 7,732 at that time. By 2025, Yuma's permanent population is expected to be approximately 109,000 (Arizona Department of Economic Security [DES] 2001b).

Consequently, the Yuma and Foothills area is the most rapidly developing area in the perimeter study area. Most of the land use development in the area is typical of trends in outward growth of suburban areas in the Southwest. Most new land use is residential; however agriculture, public lands, and light industrial are also strongly represented (see Figure 4-22, inset map). In the

[32] Zoning is the single most commonly used legal device for implementing a land use plan or for controlling the type of development within a given area. Zoning is essentially a means of ensuring that land uses are properly situated in relation to one another, providing adequate space for each type of development that may take place in a given area, so that it will conform with the overall land use objectives of the area.


Arizona
California
Inset Map Scale
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Inset Map Scale
1:300,000
Scale in Miles
Yuma
Foothills
Fortuna del Oro 2 Recreational Vehicle Park
Ligurta
Wellton
Tacna
Mohawk
Dateland
Aztec
Sentinel
Stoval
Oasis R.V. Park
Stanwix
Gila Bend Indian Reservation
San Lucy Village
Sonoran Desert National Monument
Gila Bend
Cocopah Indian Reservation
San Luis
Mexico Route 2
Barry M. Goldwater Range
Yuma County
Maricopa County
Pima County
Coffee Pot Mountain ACEC
Kaka
Ajo Airport
Ajo
Why
Tohono O'odham Indian Reservation
Cabeza Prieta National Wildlife Refuge
El Pinacate y El Gran Desierto Biological Reserve
Organ Pipe Cactus National Monument
United States
Mexico
Lukeville
1
2
3
4
5
6
7
Legend
Existing Land Use Categories
Residential
Low Density
Single-Family/Multi-Family
Mobile Home/Rec Vehicle/Single Family
Agriculture
Cropland/Pasture/Other Agriculture
Stockyard
Industrial
Heavy Industrial
Light Industrial
Commercial
Mixed Urban
Public/Quasi-Public
Conservation and Protection Areas
National Monument
National Wildlife Refuge
Undeveloped Desert/Rangeland
Base Features
Interstate Highway
Mexican Highway
U.S. and State Highways
BMGR Land Boundary
Perimeter Study Boundary
Land Use Sections
1. Yuma to the Gila Mountains
2. Gila Mountains to the Mohawk Mountains
3. Mohawk Mountains to Sentinel Plain
4. Sentinel Plain to Gila Bend
5. Gila Bend to Tohono O'odham Nation
6. Tohono O'odham Nation to Ajo
7. Ajo to Mexico
N
10 0 10 20
Scale in Miles
Existing Land Use within the BMGR Perimeter Study Area
Figure 4-22
Source: Arizona State Land Department 1997
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4-301

TABLE 4-34
MAJOR LAND USE CATEGORIES APPLICABLE TO THE PERIMETER LAND USE STUDY AREA

Category	Brief Description
Residential	Incorporates all types of residential development including rural and low-density dwelling units, single-family dwelling units, recreational vehicle and mobile home parks, and developed subdivisions. The majority of residential use occurs near urban and suburban areas; however, low-density residential uses are associated with agricultural land and facilities.
Public and Quasi-public	Includes schools, churches, cemeteries, airports and airfields, and other land uses generally associated with public use. Also includes land uses associated with governmental operations and functions, such as post offices, public works yards, and police and fire stations. The majority of these uses typically occur in urban and suburban areas, although some of these government functions or facilities are also located in smaller communities.
Commercial	Includes retail stores, service stations, office buildings, restaurants, commercial recreation facilities, and motels. The majority of commercial uses typically occur in urban and suburban areas, although some of these facilities are located in smaller communities, in association with transportation corridors, or other areas of relatively frequent human use.
Mixed-Use	Includes areas that contain dense concentrations of multiple land uses. In general, mixed uses are found in urban areas.
Industrial	Include warehouses, light and heavy manufacturing plants, processing plants, electrical substations, landfills, and salvage yards. In addition, the industrial category includes any major active surface mining activity, including gravel extraction operations or quarries.
Undeveloped Desert/ Rangeland	Includes open space or areas that have not been developed for intensive human use. These areas have no or few buildings, roads, and other structures associated with human development. Includes open rangelands used for livestock grazing within grazing allotments administered by the BLM and on lands leased from the state of Arizona.
Agricultural	Includes mechanically irrigated, flood irrigated, out-of-production agricultural areas, stockyards, and other agriculturally related uses such as production and warehousing facilities. Mechanically irrigated farmland includes areas irrigated by center pivot or overhead wheeled sprinklers. Flood irrigated farmlands include agriculture watered by flood irrigation methods. Out-of-production farmland includes areas where the land appeared to have been cultivated at one time although current agricultural production is not apparent. Other activities that typically take place within agricultural areas include storage, processing, and equipment maintenance.
Recreation, Conservation, and Protection	Areas, sites, or facilities used for recreational purposes or formally designated by a governmental agency for conservation or protection purposes. Areas designated for conservation and protection are afforded special management to preserve certain resources, values, or natural systems or processes.

vicinity of Yuma and in the Foothills area, residential development primarily consists of subdivisions for single-family dwelling units, manufactured homes, or recreational vehicles.

The Fortuna del Oro Unit 2 Recreational Vehicle Park, located north of Interstate 8 and east of Foothills Boulevard, is comprised of about 500 recreational vehicle lots that were recently approved and developed.

Several Yuma elementary schools and one junior high school exist within the study area, as does the campus of Arizona Western College, whose facilities are shared by Northern Arizona University (NAU) in Yuma (a satellite campus of NAU in Flagstaff). The Yuma County Fairgrounds and Botanical Gardens are located immediately north of MCAS Yuma. The largest area categorized as public land use in the study area is the MCAS Yuma/Yuma International

Airport, which is a joint use facility located in the northeastern corner of the study area (see Figure 4-22).

Most of the study area in the vicinity of Yuma is a mix of commercial (service stations, hotels, restaurants, grocery and souvenir stores, and other related service businesses), industrial, and residential uses. However, agriculture is by far the most dominant land use represented in the fringes of the Yuma metropolitan area (see Figure 4-22, inset map). Large industrial land uses in the vicinity consist of electrical substations located just east of Yuma (the North Gila and Gila substations). Irrigated cropland and orchards occur in the Yuma County area along both the western and northern borders of the range. Primary crops include citrus, cotton, vegetables, and small grains.

Future Land Use

Several proposed residential developments have been identified within the perimeter study area in the vicinity of Yuma. Two mixed-use projects (residential and commercial) were identified approximately two miles north of the BMGR boundary. The first proposal is known as Ciello Verde and consists of about 380 acres of annexed land proposed for a mixture of residential types. According to the City of Yuma, the land is in the preliminary stage of subdivision. It is unknown when construction of homes will occur (Albers 2002). A second proposal, known as the Lakes at Yuma, is for a master-planned community encompassing about 1,537 acres. Like Ciello Verde, no development has occurred to date. Rezoning was extended until 2003, but development is not expected to occur within that timeframe (Albers 2002). In 1997, an existing subdivision known as Tierra Mesa was proposed to expand by about 250 residences. Although this proposal was denied, some land located adjacent to Tierra Mesa has been zoned for two-acre minimum residential use. However, a preliminary plan, or plot map, has not been submitted to Yuma County to date (Carrasco 2001).

In the Foothills area, one single-family subdivision and one recreational vehicle subdivision were formally proposed in 1998. The Yuma East Estates No. 2 subdivision, comprised of about 150 single-family lots, located south of Interstate 8 and west of Fortuna Road, was approved and is currently being developed. Finally, residential growth primarily in the form of two-acre-minimum platted subdivisions is occurring South of Yuma (Carrasco 2001).

In 1998, the City of Yuma had proposed to annex 162 square miles of land west of the BMGR south to the Mexico border for the proposed Yuma Area Service Highway (see paragraph below). On 3 July 1999, the City of Yuma annexed 70 square miles of land located west of the BMGR boundary (Albers 2001).

The Yuma Area Service Highway (ASH) has been proposed by the Yuma Metropolitan Planning Organization to connect Interstate 8 with the city of San Luis and a new commercial port-of-

entry east of San Luis. This highway will be approximately 25 miles in length and will improve the transportation of trade and freight between the United States and Mexico. An EA for the project is being developed, although the release date of the draft document for public review is unknown. Final design, planning, and mapping for the Yuma ASH is currently underway. Project construction will occur in phases, with the first phase expected to begin sometime in 2002. A portion of the ASH is planned to be located within the westernmost boundary of the BMGR, between County 14th Street and County 23rd Street. This portion of the highway would be fenced to restrict access to the range. Ingress and egress to the highway in the vicinity of the BMGR would be limited to locations west and north of the BMGR. Construction of this portion of the highway is expected to occur in 2005 (Gross 2002).

The Gila Mountains to the Mohawk Mountains

Existing Land Use

This area includes the communities of Dome, Ligurta, Wellton, Roll, Tacna, and Mohawk, all located along or near Interstate 8. The combined total population for these communities in 1990 was 4,825. Although 2000 census data are not yet available for Dome, Ligurta, Roll, Tacna, and Mohawk (all located in Yuma County census tract 112), the growth of all areas is likely commensurate with the population increase of Wellton, which increased by about 75 percent from 1990 to 2000. This population growth and recent economic growth in the vicinity of these communities has fueled the construction of several residential subdivisions along Interstate 8 on both the west and east sides of the Gila Mountains near Ligurta and Wellton (Gallagher 2001).

An unauthorized development has formed along Avenue 29E, adjacent to the BMGR. The informal community was initiated by a citizens' group to provide housing to disadvantaged people. The informal community does not currently have access to a potable water supply and is not promoted by the town of Wellton. The citizens' group is currently attempting to receive a permanent water supply from the City of Yuma. The size and growth rate of the community has not been assessed. No other proposed developments to the east of Wellton have been identified to Wellton representatives (Reinhart 2001).

Much of this area land use is agricultural and undeveloped rangeland, with some residential, public industrial, commercial, and mixed use (see Figure 4-22). Residential use in this area can be characterized as low-density dwelling units within agricultural areas; older single-family subdivisions; and a more recent mixture of single-family, manufactured homes, and recreational vehicle parks. The town of Wellton is located entirely within the perimeter study area. Public land uses in the Wellton area include one elementary school, one high school, and several parks. Schools are also located in Tacna. A roadside rest area with picnic and restroom facilities is located along Interstate 8 near Mohawk. Commercial land use in the area consists of service stations, hotels, restaurants, grocery and souvenir stores, and other related service businesses.

Mixed-use areas are present in Tacna and include a combination of commercial, industrial, and residential land uses. Large industrial land uses within the area include the Copper Mountain Landfill near Wellton and an automobile testing facility operated by Ford, located along the BMGR border south of Tacna. Agricultural land uses are found throughout this area, but are more prominent to the north of Interstate 8 and include irrigated cropland and orchards. Primary crops include citrus, cotton, vegetables, and small grains. A large active stockyard operation is located immediately east of Wellton. Livestock grazing also occurs throughout this area on leased State Trust lands.

Future Land Use

Although the town of Wellton does not have a formal land use plan yet, a few planned developments exist in the vicinity. A 640-acre mixed-use development consisting of such land uses as commercial, single-family residential, recreational vehicle and mobile home lots has been proposed. If constructed, this development would be located along Avenue 29E, south of Interstate 8, about four to five miles southwest of Wellton. No definite dates have been planned for the construction to begin (Reinhart 2001).

The Mohawk Mountains to Sentinel Plain

Existing Land Use

This area includes the communities of Dateland and Sentinel; additional smaller communities include Stoval, Aztec, and Stanwix. The 1990 population for Sentinel was 5,150 and 1,430 for Dateland. Most of this area is undeveloped, with some livestock grazing, residential, and agricultural land uses (see Figure 4-22). The Sentinel Plain area that was not renewed with the BMGR land withdrawal is currently undeveloped; however, there are some small former military use areas. Low-density residential use is scattered throughout private lands in the vicinity, some associated with agricultural-type activities. In addition, the Oasis Recreational Vehicle Park is located about two miles west of Dateland, near Aztec Hills.

Public land use consists of schools located in both Dateland and Sentinel, and a community center in Dateland. In addition, a roadside rest area with picnic and restroom facilities is located along Interstate 8 near Sentinel. Commercial facilities along Interstate 8 in this area include service stations, hotels, restaurants, grocery and souvenir stores, and other related businesses. Aside from smaller, agricultural communities located in the area, there are large, unmaintained jojoba fields in the vicinity of Dateland.

Although livestock grazing occurs throughout much of the perimeter study area, this land use primarily occurs on open rangelands east of Dateland. Grazing is achieved through both grazing

allotments from federal lands (Dateland Ranch and Sentinel, two of the largest livestock grazing leases in the perimeter study area) and through land leases from the state of Arizona. Grazing capacities are measured by the number of acres of land required to support one animal unit for a month, or acres per animal unit month (AUM). Dateland Ranch consists of 4,104 acres of federal land, which can accommodate 75 AUMs. The Sentinel allotment consists of 18,564 acres, which can accommodate 360 AUMs.

Future Land Use

A residential airpark in Dateland, known as El Camino del Sol Airpark, has been proposed by a local developer. The town of Dateland does not have a formal land use plan and consequently, there has not been a formal proposal for the airpark. Although there has been discussion of its development, it does not appear that the airpark will be developed in the near future (Cory 2001).

The town of Dateland has also encouraged the future development of fallow (plowed, but uncultivated) agricultural land on both the north and south sides of Interstate 8. No new development of farm acreage is planned; however, fallow agricultural land that was previously used to grow cotton is currently being used to farm alfalfa near Aztec Mountain. In addition, a dairy has been erected south of Interstate 8 at the Aztec exit and is now in operation (Cory 2002).

The Air Force has suggested that future management of the Sentinel Plain include only uses that would be compatible with the military mission. Low-intensity recreation and resource preservation management would be compatible with future uses, but incompatible uses would include livestock grazing, agriculture, residential or commercial development, and high-intensity recreational use (U.S. Air Force 2000a).

<u>Sentinel Plain to Gila Bend</u>

Existing Land Use

This stretch of land includes the town of Gila Bend and the community of Paloma Ranch, located along Interstate 8 west of Gila Bend. Most of the area is open rangeland used for livestock grazing and agriculture. Other land uses—including residential, commercial, industrial, and mixed use—occur in and around Gila Bend (see Figure 4-22). The population of Gila Bend in 2000 was 1,750; agriculture is the principal economic activity.

Residential land use within the vicinity of Gila Bend primarily consists of older, single-family houses in established subdivisions, with other dispersed mobile homes and single-family dwelling units. Although not as developed as Gila Bend, Paloma Ranch consists of at least 20

residences. This entire area also consists of low-density residential use, some associated with agricultural uses, scattered throughout private lands within the perimeter study area.

Paloma Ranch, where cotton and small grains are grown, is one of the larger agricultural areas in the perimeter study area. In this same area, large areas of land were previously cultivated, but now are out of production and, just south of Interstate 8, there are some abandoned stockyards. Recently, zoning changes have been made to some portions of land near Paloma Ranch to accommodate potential future light and heavy industrial as well as dense residential land use (Dill 2001).

The town of Gila Bend is located entirely within the perimeter study area. Public and quasi-public land uses within the town include an elementary school and high school; a medical clinic; various recreational facilities, including a museum and parks; public works facilities; an Arizona Department of Public Safety substation; cemetery; several churches; and the Gila Bend Municipal Airport.

Commercial use consisting of service stations, hotels, restaurants, grocery and souvenir stores, and other related service businesses occur in and near Gila Bend. Large industrial land uses consist of the Gila Bend Regional Landfill and the Gila Bend electrical substation, located west of Gila Bend.

Future Land Use

Two electrical power plants have been planned for the vicinity of Gila Bend. Panda Power began construction of a power plant near Gila Bend in 2001. Gila Bend Power Partners, LLC, expects to start construction in 2002 on another power plant. When constructed, this power plant will be located in the Paloma Ranch area, west of Gila Bend. Developers have purchased land around the two power plants for potential mixed land use consisting of trailer homes, mobile homes, and single-family residences. However, development of these areas is contingent upon the completion of the nearby power plants (Dill 2001).

The town of Gila Bend has expressed interest in annexing 10 square miles of land south of Interstate 8 and immediately east of the BMGR boundary. However, no immediate plans for annexation are available (Lewis 2001).

Gila Bend to the Tohono O'odham Nation

Existing Land Use

To the east of Gila Bend, approximately 77,957 acres of land near the Sand Tank Mountains are in the process of being relinquished from the BMGR and consequently, from future DoD management. This and other land in the area (all totaling 486,603 acres) have been designated as the Sonoran Desert National Monument and is managed by the BLM.

South of the national monument is the Tohono O'odham Nation and the Native American community of Kaka. Residential land use in this area is very dispersed. Kaka is categorized as a community with 20 or more residences. However, most of the residential land use on the Tohono O'odham Nation is associated with ranching and the grazing of livestock, and may include seasonal cattle camps.

Livestock grazing also occurs on open rangelands east of Gila Bend, near Vekol. Grazing allotments and land leases are provided by both the federal and state government, respectively. Federal grazing allotments in the area include Stout (5,962 acres), Big Horn (151,077 acres), Lower Vekol (21,892 acres), Vekol (20,848 acres), South Vekol (49,349 acres), and Kirian (17,094 acres).

Future Land Use

The Santa Rosa to Gila Bend 230 kilovolt (kV) transmission line has been proposed to extend from Santa Rosa, located east of the study area to Gila Bend. The Certificate of Environmental Compatibility has been issued by the Arizona Corporation Commission, and right-of-way has been acquired for the line. According to the Arizona Public Service 10-year plan, the anticipated construction date of the transmission line is 2006; however, that date could be advanced or deferred (Stoltine 2001).

The Tohono O'odham Nation to Ajo

Existing Land Use

The largest community in this area is the town of Ajo, Arizona. Historically, Ajo's economic base focused on the mining industry. Phelps Dodge mining operations began in the early-1900s, but were closed in 1986 due to the low market price of copper. Since then, the majority of Ajo's population has consisted of retirees and the economic base has revolved around tourism, service, and other commercial businesses.

Most of the land in this area is open rangeland; however, the Ajo Municipal Airport is a large public land use and there is industrial land use associated with copper mining south and east of Ajo and mixed uses in and around Ajo (see Figure 4-22). Through the MLWA of 1999, a portion of land north of Ajo, surrounding the Ajo Municipal Airport, was relinquished from BMGR boundaries. Land management responsibilities for this land, totaling 2,779 acres, now belongs to the BLM.

Residential land use in Ajo primarily consists of older single-family houses in established subdivisions, with other dispersed mobile homes and single-family dwelling units. Dispersed residential uses exist outside the town of Ajo, with some associated with ranching and livestock grazing.

Public and quasi-public land uses within the community of Ajo include an elementary, junior high, and a high school; an outpatient clinic; several public parks; a library; several churches; and the Ajo Municipal Airport.

Commercial land uses in Ajo include service stations, hotels, restaurants, grocery and souvenir stores, and other related service businesses. Industrial land use in Ajo consists of the inactive PDAI Mine, located in the southeast portion of Ajo. Federal grazing allotments and state grazing leases exist throughout this area. Approximately 98,000 acres, or about 3,800 AUMs, of federal land is leased for grazing purposes in the Childs area north of the Ajo Municipal Airport.

Future Land Use

Although a definite date has not been set, the Phelps Dodge Corporation proposes to resume mining operations in Ajo sometime in the future. The PDAI Mine is located on the southeast side of Ajo. The primary activities at the mine site are expected to include copper ore mining, milling, and concentrating operations. The company plans to hire a workforce of about 350 employees and invest $240 million in modernization of its pit and ore milling equipment. Future land uses associated with the proposed mine may include additional residential, industrial, and commercial uses; however, no specific plans have been made for these uses to date.

As part of the proposed mining operations, the historic Tucson, Cornelia, and Gila Bend Railroad will be upgraded for use during the construction and operation of the mine to haul concentrate when the concentrator is in operation.

The Ajo Improvement Company, a subsidiary of Phelps Dodge Corporation, received approval for a right-of-way grant to construct and operate a 230 kV transmission line from Gila Bend to Ajo. The historic Tucson, Cornelia, and Gila Bend Railroad may also be reactivated, running from Gila Bend to Ajo. However, no changes to existing land uses have been proposed for these projects.

Ajo to Mexico

Existing Land Use

This portion of the perimeter study area extends along the northern and western Cabeza Prieta NWR borders as well as the northern Mexico border (at BMGR—West). Land located south of Ajo is largely undeveloped rangeland managed by the BLM; however, recreation, conservation, and protection areas and sites are a major land use within this portion of the perimeter study area. (The Organ Pipe Cactus NM is located approximately 12 miles south of Ajo and its western boundary is immediately adjacent to the Cabeza Prieta NWR [see Figure 1-1].) Public, commercial, mixed-use, industrial, and agricultural land uses are not present in this portion of the perimeter study area. Residential land use consists of dispersed dwellings associated with remotely-located ranch locations.

Prior to the MLWA of 1999, about 822,000 acres of the Cabeza Prieta NWR were within the BMGR and 39,000 acres of the refuge were outside the BMGR. Military use of the Cabeza Prieta NWR lands is currently limited to a few unmanned electronic instrumentation sites, and the overlying airspace is used for aerial training exercises. However, prior to 1960, bombing and strafing of targets within the alluvial basins of the Cabeza Prieta NWR were authorized. In addition, an alternate air-to-air range was established over part of the refuge, although this range was last used in 1994. The refuge also functioned as an area in which ordnance and targets used in air-to-air or surface-to-air training might fall. The lands underlying the alternate air-to-air range were particularly subject to debris from expended Deployable Aerial Rigged Targets (or DARTs), which were used as aerial tow targets. Many DARTs and tow cable remain within the refuge. With the passage of the MLWA of 1999, the Cabeza Prieta NWR was excluded from the lands withdrawn for the BMGR.

The refuge was established in 1939, primarily for the protection of the desert bighorn sheep, and also for the conservation and development of natural wildlife and resources. The Arizona Desert Wilderness Act of 1990 designated 803,418 acres of the refuge as Wilderness, including most of the portions of the refuge located within the range perimeter study area. Permission for access to the Cabeza Prieta NWR is the same as the permit obtained to access the BMGR. Hiking, photography, wildlife observation, camping, and bighorn sheep hunting are recreational activities that are allowed within the refuge as long as they are compatible with refuge and Wilderness management goals. Vehicles are restricted to three approved roads on the refuge, two of which are within the study area and provide access to the BMGR from the refuge. (More information about recreation opportunities at and use of the Cabeza Prieta NWR is provided in Section 4.12.1).

Immediately south of the international border is the Reserva de la Biosfera de El Pinacate y El Gran Desierto de Altar. Recreational use of the biosphere reserve in Mexico is limited to primitive camping and hiking (More information about recreation opportunities at and use of the biosphere reserve is provided in Section 4.12.1).

The area located immediately south of the BMGR/international boundary is environmentally harsh and sparsely populated. Currently, there are no permanent Mexican communities located just south of the BMGR. San Luis de Colorado, Sonora, Mexico is located approximately 15 miles west of the western BMGR boundary and has a population of approximately 16,465 people (Arizona DES 2001b). San Luis de Colorado is a major, twin-plant (maquiladora) industrial city. The twin-plant concept uses American manufacturing plants located on both sides of the border to take advantage of favorable wage and operating differential costs.

Mexico Route 2 is the main east-west corridor south of the BMGR/international border and several *ejidos* that have periodically occurred along this stretch of road have been impermanent. The harsh environment and lack of adequate water supplies has contributed to the lack of permanency. Where groundwater supplies do exist, successful agricultural communities are present. One such area is located west of San Luis where groundwater is utilized for irrigation (U.S. Air Force 1986). In addition, changes in agricultural policy in Mexico combined with highly competitive and variable markets have made small-scale farming less profitable. Therefore, small farm sites have been abandoned as people move into the urban centers such as Hermosillo, Mexicali, Tijuana, Nogales, and Guaymas (Emanuel 2000).

Although not included within the perimeter study area, several of these small farm sites were identified south of the Cabeza Prieta NWR. These sites are depicted on the 1:250,000-scale Defense Mapping Agency Joint Operations Graphic map (dated 1990) and include: Los Vidrios (a gas station) and Las Cuervas, (both located on the Pinacate Lava Flow, which crosses the international border), El Solito, Mina del Desierto, and El Pedregal. South of the BMGR, the map depicts one ranch site, named Rancho Pozo de Dona Victoria, located south of Mexico Route 2, just west of the Tinajas Altas Mountains.

The 1:250,000-scale INEGI topographic map (Mexicali I11-12, undated) depicts two *ejidos* immediately south of Mexico Route 2 and west of the Tinajas Altas Mountains; they consist of Ejido La Reforma Agraria and Ejido el Sinaloense. Two communication towers used by the biological reserve are also located just south of the highway in this area. One is located just west of the Tinajas Altas Mountains and is referred to as Microondas Cerro Pinto and the other is termed Microondas el Desierto.

Future Land Use

No land use plans were identified for the portion of Mexico included in the perimeter land use study area, so no proposed land uses were identified. However, based on historical land use patterns and the harshness of the environment, it is unlikely that new land uses for this part of Mexico are proposed.

4.15.2 Interrelationship Between the Military Mission and Land Use

As military training activities continue on the BMGR, population growth and subsequent land use changes within the communities of Yuma, Wellton, and Gila Bend are also occurring. The military will continue to coordinate with nearby planning departments regarding land use compatibility with military activities in order to promote public health, safety, and general welfare in the areas surrounding the range and, at the same time, protect the military mission accomplished at the range. Oftentimes, if incompatible land uses are located adjacent to a military installation, the ongoing mission is compromised or threatened. During every round of base realignment and closure actions, compatibility was a major factor in determining the long-term viability of military installations. At this time in American history, when another round of base realignment and closures may soon be a reality, the importance of compatibility of adjacent land uses to the ongoing military mission cannot be overstated.

The primary means for examining land use compatibility in areas surrounding DoD air and range installations is through the Air Installation Compatible Use Zone (AICUZ) and/or Range Air Installation Compatible Use Zone (RAICUZ) planning process. An AICUZ or RAICUZ study provides information about noise contours and compatible land use guidelines for areas surrounding the installation. AICUZ and RAICUZ studies that have been prepared for the BMGR have focused on retaining low-density land uses such as agriculture and sparsely populated residential areas near airfield and range boundaries (see Section 4.15.3, Existing Management Responsibilities and Plans, for more information). Implementation of those aspects of the AICUZ or RAICUZ study recommendations with regard to off-installation matters is the responsibility of the adjacent communities. For example, adjacent communities may consider the AICUZ or RAICUZ recommendations in making zoning decisions. After an AICUZ or RAICUZ study has been implemented, both the military and adjacent communities are encouraged to notify one another regarding changes in training activities and land use policies, respectively. This relationship has proved successful for Yuma County, where the county has formally adopted the land use compatibility recommendations that were provided in the *Auxiliary Field 2 AICUZ Study*. Currently, Yuma County requires disclosure statements for properties that fall within the noise footprint of this study.

On the range, aside from AICUZ and RAICUZ related land use planning restrictions, preservation of man-made and natural resources on the BMGR indirectly occurs as a result of the

military mission. In addition, adjacent protection and conservation areas within the perimeter study area, such as the Cabeza Prieta NWR and the Sonoran Desert NM, also prohibit certain land use development. As such, the combined land that is restricted from various kinds of future development makes for a large tract of healthy Sonoran Desert.

4.15.3 Existing Regulatory and Statutory Requirements and Management Plans and Actions

Comprehensive, area, and resource management plans have been created for locations within the perimeter study area. Table 4-35 lists these documents and the year in which they were adopted. A description of each plan is provided following the table. The state of Arizona does not have a comprehensive management plan for lands in the vicinity of the range; however, Maricopa, Pima, and Yuma counties each have regional land use planning documents. Towns and cities have also adopted local land use plans.

TABLE 4-35
LAND USE MANAGEMENT PLANNING DOCUMENTS FOR AREAS WITHIN THE PERIMETER STUDY AREA

Document Title	Year Adopted
Federal Agency Land Management Plans	
Bureau of Land Management Yuma District Resource Management Plan Lower Gila South Resource Area RMP and Amendment	 1985 1986, 2000
U.S. Fish and Wildlife Service Cabeza Prieta National Wildlife Refuge Planning Needs Assessment Draft Comprehensive Conservation Plan	 1986 1998
RAICUZ and AICUZ Plans	
Amendment to the 1986 Range Air Installation Compatible Use Zone (RAICUZ) Study, Restricted Area R-2301 West, MCAS Yuma	1988
U.S. Marine Corps Air Station Yuma AUX-2 Air Installation Compatible Use Zone (AICUZ)	1993
AICUZ-Volumes I and II, Gila Bend Air Force Auxiliary Field, Arizona	1997
County Land Use Plans	
Maricopa County Comprehensive Plan	1997
Maricopa Association of Governments Open Space Plan (Desert Spaces)	1995
Yuma Joint Land Use Plan	1996
Pima County Comprehensive Plan	1992
The Sonoran Desert Conservation Plan	2000
Local Land Use Plans	
Town of Gila Bend General Plan (with amendments)	1996
Ajo/Why Zoning Plan	1981

4.15.3.1 County Land Use Plans

Maricopa County

MAG is a council of governments that serves as the regional agency for the metropolitan Phoenix area. The MAG provides a regional forum for analysis, discussion and resolution of issues including areas of transportation, air quality, environment, regional development, and social services. The MAG membership currently consists of the 24 incorporated cities and towns within Maricopa County, Gila River Indian Community, Salt River Pima Maricopa Indian Community, Maricopa County, ADOT, and Citizens Transportation Oversight Committee; however, Gila Bend is the only community with MAG membership that is included in the perimeter study area. Land use publications produced by MAG include the MAG General Plan Land Use (a compilation of town-level General Plans) and the MAG Desert Spaces Plan. Adopted in October 1995, the Desert Spaces Plan is a Regional Open Space Plan, to guide members of MAG in protecting sensitive open spaces, while allowing future growth and development.

Pima County

For Pima County, PAG is the Metropolitan Planning Organization for the greater Tucson area. PAG member jurisdictions include the cities of Tucson and South Tucson, Pima County, and the towns of Marana, Oro Valley, and Sahuarita. PAG membership within the perimeter study area includes the Tohono O'odham Nation and Ajo (located within Pima County). Like the MAG, PAG analyzes issues that cross jurisdictional boundaries such as air quality, water quality, transportation, land use, and human services. Pima County land use publications include the Pima County Comprehensive Plan and the Sonoran Desert Conservation Plan. The Pima County Comprehensive Plan was adopted by the Board of Supervisors in October 1992 and consists of three documents: the Land Use Plan, Regional and Special Area Plan Policies, and the Strategic Action Plan. However, the BMGR is not included in the Pima County Comprehensive Plan. For the Ajo area, no amendments or changes have been made to the Plan since 1997 (Fink 2001).

In 1998, the Pima County Board of Supervisors launched the Sonoran Desert Conservation Plan with the goal of combining short-term actions to protect and enhance the natural environment and long-range planning to ensure that natural and urban environments coexist. This document, the draft Preliminary Sonoran Desert Conservation Plan, provides a summary of two years of conservation actions and planning, and provides objectives and goals for Pima County land use planning. The draft plan identifies a number of potential conservation opportunities (Pima County 2000).

Yuma County

The city and county of Yuma prepared a Joint Land Use Plan for lands in the vicinity of MCAS Yuma. The Joint Land Use Plan serves as an amendment to the respective City and County General Plans covering areas of mutual interest. The plan represents the combined efforts of the city and county of Yuma to achieve the following:

- a common "blue print" of land uses and land use development policies for the future economic growth and development of lands within the incorporated and unincorporated areas around the City of Yuma

- a foundation for the compatibility of land use activities in the vicinity of the MCAS Yuma/Yuma International Airport. The primary economic assets of the area (agriculture, the air station, and tourism) are protected, reinforced and supplemented by the expansion of industrial sector opportunities that will provide more year-round employment prospects.

4.15.3.2 Local Land Use Plans

The town of Gila Bend adopted the *Gila Bend Master Plan Update* on 27 August 1996 to guide decisions about growth and development in the town of Gila Bend. The Gila Bend Master Plan Update consists of three plan elements, which together guide growth of the community. The plan elements include: land use, circulation and public facilities, and services. The land use element also contains economic development strategies for the town.

For the town of Ajo, the Ajo Area Plan map was prepared in 1967 (with the most recent amendment in 1981) and depicts local zoning classifications; however an updated land use plan has not been prepared.[33]

The Tohono O'odham Nation has no comprehensive plan for the entire reservation or area plans for the portion of the Nation within the perimeter study area.

4.15.3.3 RAICUZ and AICUZ Reports

In April 1988, the U.S. Navy produced an amendment to a 1986 RAICUZ prepared for R-2301W, in the portion of the range utilized by MCAS Yuma. The 1986 study was based on new target center locations for the Moving Sands and Cactus West targets (see Figure 2-2). A RAICUZ amendment was necessary in 1988 because of three major changes in range use,

[33] Figure 4-22 depicts existing land uses in Ajo.

including changes in the entry and exit points to Restricted Area R-2301W, changes in flight patterns for target approach and fly-over, and a more precise determination of noise contours and Accident Potential Zones (APZs). The study activities associated with the RAICUZ amendment identified several new findings relevant to the use of R-2301W and the Moving Sands and Cactus West targets. Because of changes in range entry points, flight tracks, and target locations, the amendment places RAICUZ concerns entirely within the range boundaries. Therefore, the issues of incompatible zoning categories within the RAICUZ were eliminated. Additionally, airspace concerns were minimized and the noise contours were contained within the range boundaries.

Two AICUZ reports have been created at two installations that are located somewhat near the BMGR boundary and have air operations that warrant such study (i.e., take-offs and landings)—AUX-2 and Gila Bend AFAF. As further described in Section 4.15.2, preparation of AICUZ reports demonstrates the DoD's recommendations for consideration in the local land use planning processes. The areas identified for compatibility are those that are affected by incompatible noise levels and/or APZs. As local communities (such as Yuma and Gila Bend) prepare land use and zoning ordinances, the DoD provides input, through the AICUZ planning process, on their flight activities and how these activities might relate to the community.

In 1993, the MCAS Yuma AUX-2 AICUZ was prepared. This AICUZ identified several land use incompatibilities west of the BMGR, including recreational vehicle parks and single-family residences. For AUX-2, relatively high levels of noise exposure extend off the BMGR to the west. Areas of concern within the AICUZ footprint include the Pioneer Rancheros residential subdivision, the proposed Yuma ASH, and private and State Trust lands located immediately west of the BMGR. The AICUZ study provides recommendations that residential use be restricted in these areas.

A two-volume AICUZ study report for the Gila Bend AFAF on the eastern side of the range was prepared in 1997 as an amendment to the 1982 Gila Bend Airfield AICUZ. This study quantified noise zones and APZs, identified existing land uses and future community plans, and developed alternatives for minimizing incompatibilities. In this area, relatively high noise exposure levels extend off the BMGR to an area immediately north and east of the range. The study identified one incompatible land use, consisting of a single-family residence located within one-quarter mile from the installation. The AICUZ document describes actions the Air Force can take in providing input to the local planning process. In addition, recommendations are provided to the leaders of Gila Bend and Maricopa County for the incorporation of AICUZ policies and guidelines into future land use planning.

4.15.3.4 Agency Resource Plans

Bureau of Land Management

Lower Gila South RMP

The 1985 *Final Lower Gila South Resource Management Plan and Environmental Impact Statement* addresses management of public lands within the Lower Gila South Resource Area, which includes public lands adjacent to BMGR—East. (The 1990 Goldwater Amendment to the 1985 Lower Gila South RMP addresses management of the BMGR.) In 2000, a FONSI for an Amendment and Environmental Assessment to the RMP was signed. The 1985 RMP and EIS focused on rangeland management, wilderness, land tenure adjustments, and utility corridors within the area. The RMP did not prescribe major changes to rangeland management or land tenure, but recommended that two wilderness study areas near the BMGR, Table Top and South Maricopa Mountains, be designated as wilderness (U.S DOI, BLM 1985). These two areas were formally designated as wilderness by the Arizona Desert Wilderness Act of 1990. The 2000 RMP amendment slightly changed land tenure adjustment, desert tortoise habitat management, desert bighorn sheep augmentation and reestablishment, wild burro management, recreation management, and oil and gas development decisions (U.S. DOI, BLM 2000d).

The BLM has initiated the process of preparing a new RMP for all of the public lands in what is now referred to as the Phoenix South Planning Area. The planning area encompasses approximately 1.5 million acres of public land in south-central Arizona and includes the Sonoran Desert NM, although (as noted below) a separate plan will be prepared for the monument lands. The planning process will identify BLM's management actions on the public lands for the next 15 to 20 years (U.S. DOI, BLM 2002b).

Yuma District RMP

The *Yuma District Final Resource Management Plan and Environmental Impact Statement* addresses future management options for the federal lands administered by the BLM through its Yuma Field Office in Yuma, Arizona. These lands are located in the BMGR—West perimeter study area for this land use assessment. The plan focuses on resolving the following six resource management issues: wildlife habitat, special management areas, grazing, land ownership adjustment, rights-of-way, and recreation.

Six land-use plan alternatives, including the proposed Resource Management Plan, are analyzed in the document. Each alternative represents a complete and reasonable plan to guide future management of public lands and resources. One alternative represents "no action" or a continuation of existing management. The other five alternatives were developed to provide a wide range of options from emphasis on resource production to emphasis on resource protection.

The draft EIS was published in January 1985, and the final was published with a Record of Decision in late 1985.

Sonoran Desert National Monument Resource Management Plan (In Preparation)

The BLM has initiated plans to prepare a RMP for the Sonoran Desert NM, which will occur concurrently with the planning process for a new RMP for the Phoenix South Planning Area (U.S. DOI, BLM 2002b). The Sonoran Desert NM, totaling approximately 486,603 acres of land in the northeastern portion of the BMGR, was designated by President Clinton on 17 January 2001. Approximately 486,392 acres of the lands in the area are under the jurisdiction of the BLM in the Department of the Interior. The remaining portions of land are under state or private ownership/management and are scattered throughout the monument. Although always included in the monument designation, Area A or the Sand Tank Mountains area, consisting of 77,957 acres, was under the joint jurisdiction of the BLM and the DoD by military withdrawal prior to 6 November 2001, when the military land withdrawal for this parcel was terminated. According to the Presidential Proclamation establishing the monument, the area will be managed by the BLM with the overriding purpose of protecting the objects and values for which the monument was established. BLM will involve concerned Native American tribes and groups, as well as the local and area communities, in developing the management plan.

Most of the Sonoran Desert NM has been evaluated for its Wilderness characteristics under the FLPMA and approximately 158,975 acres within the monument—the North Maricopa Mountains, South Maricopa Mountains, and Table Top—were designated Wilderness by the Arizona Desert Wilderness Act of 1990. The monument also contains a relatively frequently used, 20-mile trail corridor. Several important historic trails are found along this trail corridor including the Juan Bautista de Anza National Historic Trail, Mormon Battalion Trail, and Butterfield Overland Stage Route. In addition, the 3,520-acre Vekol Valley ACEC, previously recognized and protected for its desert grasslands habitat, is located in the southern portion of Sonoran Desert NM.

U.S. Fish and Wildlife Service

Cabeza Prieta NWR management is based primarily on reference to the general purposes of the refuge, USFWS's Wilderness Objectives, the National Wildlife Refuge System Improvement Act of 1997 (P.L. 105-57), and the Refuge Goal Statements adopted in 1983 and renewed in 1986 in the Cabeza Prieta NWR Planning Needs Assessment (USFWS 1998c).

In 1999, the USFWS started the process of drafting an EIS for the comprehensive conservation plan. The EIS will most likely be completed sometime in 2003 (Morgart 2001).

4.15.4 Information Not Currently Available to Support Transboundary and Domestic Perimeter Land Use Management

The current lack of some data or information poses potential challenges for the future management of transboundary and domestic perimeter land use issues affecting the BMGR. This currently unavailable information was identified during the preparation of the affected environment section of this EIS. It does not constitute incomplete or unavailable information needed to conduct the environmental impact analysis presented in Chapter 5 in accordance with 40 CFR §1502.22. Although additional transboundary and domestic perimeter land use information needs may be defined in the future, those identified in this document include:

- *Mexico*. There is no current source of information that tracks the geographic census of the *ejidos* in northern Mexico and the land use impacts of the rapid expansion of Mexican border cities and their surrounding neighborhoods (Emanuel 2000).

- *United States*. There is no source of information that tracks current, planned, and projected population growth, economic development, and land-use in the United States in the vicinity of the BMGR boundary.

4.16 CULTURAL RESOURCES

The cultural environment includes those aspects of the physical environment that relate to human culture and society, along with the social institutions that form and maintain communities and link them to their surroundings. Section 101(b)(4) of NEPA established a federal policy of conserving the historic and cultural, as well as the natural, aspects of our national heritage. Regulations implementing NEPA stipulate that federal agencies consider the consequences of their undertakings, such as implementing the proposed BMGR INRMP, on historic and cultural resources (40 CFR Part 1502.16[g]).

Cultural resources represent the nation's collective heritage, and broad public sentiment for protecting these heritage resources has been codified over the years in numerous federal, state, and local laws (King 1977 and others; King 1998). Implementing regulations define the following five specific categories of resources:

1. **Historic properties** are defined by the NHPA as districts, sites, buildings, structures, and objects eligible for inclusion on the National Register of Historic Places (National Register), which includes resources of local and state significance as well as national significance.

2. **Cultural items** are defined by the Native American Graves Protection and Repatriation Act as human remains, funerary objects, sacred objects, and objects of cultural patrimony.

3. **Archaeological resources** are defined by the Archeological Resources Protection Act (ARPA) as material remains of human life or activities that are at least 100 years of age, and which are of archaeological interest.

4. **Sacred sites** are defined by Executive Order 13007 as any specific, discrete, narrowly delineated location on federal land that is identified by an Indian tribe, or Indian individual determined to be an appropriately authoritative representative of an Indian religion, as sacred by virtue of its established religious significance to, or ceremonial use by, an Indian religion; provided that the tribe or appropriately authoritative representative of an Indian religion has informed the agency of the existence of such a site. The American Indian Religious Freedom Act directs federal agencies to not unduly limit access to such sites. The MLWA defines sacred site as any specific, discrete, narrowly delineated location on Federal land that is identified by an Indian tribe, or its designee, as sacred by virtue of its established religious significance to, or ceremonial use by, an Indian religion, but only to the extent that the tribe or its designee, has informed the Secretary of the Navy or the Secretary of the Air Force of the existence of such site. The MLWA also stipulates that neither the Secretary of the DoD, the Secretary of the Navy, the Secretary of the Air Force, nor the Secretary of the Interior shall be required under section 552 of Title 5, U.S. Code (i.e., The Freedom of Information Act), to make available to the public any information concerning the location, character, or use of any traditional Indian religious or sacred site located on lands withdrawn and reserved by the MLWA.

5. **Collections** are defined by regulations for *Curation of Federally-Owned and Administered Collections* (36 CFR, Part 79) as material remains that are excavated or removed during a survey, excavation, or other study of a prehistoric or historic resource and associated records prepared or assembled in connection with such studies.

Primary regulatory requirements for protecting cultural resources are those of Section 106 of NHPA, which mandates that as federal undertakings are planned and implemented, the responsible federal agencies give due consideration to National Register-listed or eligible properties.

Ordinarily a property must be 50 years old and possess significance regarding American history, architecture, archaeology, engineering, or culture to be eligible for the National Register. Eligible properties also must possess integrity of location, design, setting, materials, workmanship, feeling, and association, and meet at least one of four criteria:

- are associated with events that have made a significant contribution to the broad patterns of our history (Criterion A)

- are associated with the lives of persons significant in our past (Criterion B)

- embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant distinguishable entity whose components may lack individual distinction (Criterion C)

- have yielded, or may be likely to yield, information important in prehistory or history (Criterion D) (Title 36 CFR, Part 64)

In general, properties that are eligible for inclusion under only Criterion D must possess integrity of location, and in some instances design, materials and/or workmanship. That is, they must be sufficiently intact and undisturbed so that important information may be obtained by studying them.

Properties that are eligible under other criteria often must also possess integrity of setting, feeling, and association. For example, a panoramic vista without modern intrusions such as roads and powerlines might be an essential component of a rock shelter site eligible for inclusion on the National Register for its association with a particular tribal ceremonial activity (probably under Criterion A). The setting and feeling of such a place would be an essential aspect of its character that could be damaged or destroyed by activities that take place some distance from the site itself. Likewise, a historic landscape (which might be eligible under Criterion A, B, or C) including a farmhouse, outbuildings, and orchards is likely to be adversely affected by the introduction of visual elements—such as a cell phone tower—out of character with its setting or feeling. Such properties may also be adversely affected by noise. Places eligible for their cultural importance to Native Americans may be particularly vulnerable to the introduction of modern visual or auditory intrusions that are inconsistent with their significant characteristics.

Federal undertakings include projects, activities, or programs funded in whole or in part by a federal agency, or requiring a federal permit, license, or approval. Regulations for *Protection of Historic Properties* (Title 36 CFR, Part 800) implement the NHPA by defining a process for demonstrating appropriate consideration of National Register-listed or eligible properties through consultation with State Historic Preservation Officers, the federal Advisory Council on Historic Preservation, and other interested organizations and individuals. Cultural resources are addressed in this EIS in compliance with both NEPA and NHPA.

4.16.1 Existing Conditions

4.16.1.1 Inventory Methods

Luke AFB and MCAS Yuma have arranged for many cultural resource studies on BMGR. A recent overview summarizes the results of these studies completed through 1995, as well as studies conducted on the range by other agencies and organizations during approximately the last half-century (Ahlstrom 2000). The majority of the studies focused on military use areas but some have been conducted for non-military activities or to address generalized research issues regarding past land use, such as recent surveys of the Growler and San Cristobal washes (Slaughter and others 2000), and a survey in the vicinity of Tinajas Altas, an important natural water catchment in the western BMGR (Hartman and Thurtle 2000). These data sources, as summarized by Ahlstrom (2000) are the primary basis for characterizing the cultural resource component of the affected environment of the BMGR.

4.16.1.2 Cultural History

A brief overview of the history of human use and occupation of the BMGR and surrounding region is included here to provide a context for understanding and evaluating the importance of the cultural resources on the range. A more detailed overview is provided in the ICRMP being prepared by Luke AFB (U.S. Air Force 2002). The cultural history of BMGR can be divided into seven periods: Paleo-Indian (circa 10,000-8,000 B.C.), Archaic (circa 8,000 B.C. – A.D. 200), Ceramic (circa A.D. 200-1500), Early Historical (A.D. 1540-1848), Late Historical (A.D. 1848-1941), World War II (A.D. 1941 - 1945), and Cold War (A.D. 1946-1989).

Archaeologists consider the BMGR to lie within a cultural area known as the Western Papaguería. Since the time of initial Spanish exploration, southwestern Arizona and northern Sonora, Mexico have been known as the Papaguería (Haury 1975:3). The term Papaguería is derived from the O'odham word for tepary bean, which the Spanish condensed to "Papago" (Nabhan 1985). The Papaguería was the traditional territory of the Hia C-ed O'odham (formerly known as the Sand Papago Indians) and Tohono O'odham (formerly known as the Papago Indians). The Western Papaguería includes the region bounded by the Colorado River to the west, the Gila River to the north, the Papago Indian Reservation (home to the Tohono O'odham Nation today) to the east, and Puerto Peñasco, Sonora, to the south. Formerly, the Hia C-ed O'odham inhabited the area, although other cultural groups such as the Quechan, Cocopah, Yavapai, Apache, Maricopa, and the Tohono O'odham used portions of the region as well. Two tribes now located some distance from the BMGR—the Hopi Tribe and the Pueblo of Zuni—also have made claims of affiliation based on their oral histories and their association with the archaeological culture called Hohokam, which is well represented on the BMGR.

Paleo-Indian Period

The entire pre-Ceramic period is characterized by reliance on native plants and animals and mobile settlement systems. Archaeologists refer to the initial pre-Ceramic period occupation as the Paleo-Indian period, although some consider the Malpais archaeological complex to be an even earlier occupation. The San Dieguito and Clovis archaeological complexes represent other Paleo-Indian period occupations, each characterized by a distinctive tool kit. Association with the hunting of now extinct big game species, including mammoths, distinguishes the Clovis and Folsom complexes. The Late Pleistocene climate during the Paleo-Indian Period was wetter and cooler than the present, with native vegetation including grasslands and pinyon and juniper woodlands.

Archaic Period

During the subsequent Archaic period, the climate became warmer and drier and the current, very arid conditions of the northwestern Sonoran Desert were established. The Archaic period in southwestern Arizona is represented by two archaeological complexes, known as Amargosa and Cochise, as well as chronological subdivision into Early, Middle and Late periods (Huckell 1984). Until the very end of the period, Archaic populations collected a broad spectrum of native plant and animal foods as they moved seasonally among different environmental zones. Agricultural villages were established during the end of the Late Archaic period (now sometimes referred to as the Early Agricultural period) in areas east of the BMGR. It is not known whether this change in subsistence strategies also occurred in the Western Papaguería.

Ceramic Period

The Hohokam and Patayan cultural traditions are represented in the Western Papaguería during the Ceramic period. The Hohokam culture was centered in the Gila-Salt Basin to the east, and the Patayan along the lower Colorado River. A third cultural tradition known as Trincheras was centered to the southeast in northern Sonora, and may be represented on the BMGR as well. As with the Archaic period, various environmental shifts (relating primarily to increased or decreased precipitation) are believed to have influenced the settlement and subsistence strategies of regional populations, but details remain to be defined.

The Papaguerían regional variant of the Hohokam tradition is recognized principally on the basis of pottery styles that mirror better-known changes through time in ceramic manufacture in the Gila-Salt and Tucson basins. The question of what subsistence-settlement systems were adopted by Hohokam occupants of the Western Papaguería is of considerable interest, but more

excavation data are needed. Hypothesized adaptations include (1) sporadic forays to procure specific resources or to access travel corridors; (2) use of the region as a secondary resource zone visited regularly by groups with permanent residences in better watered areas, such as along the Gila River; and (3) the practice of agriculture (particularly, a strategy that relies on the manipulation of rainfall runoff on the alluvial fans at the mouths of arroyos) along with wild resource procurement. The third adaptation has two variants—one in which farming is practiced on a seasonal basis by people from permanent villages outside of the region, and a second that views Hohokam occupants of the Western Papaguería as permanent residents, at least during a portion of the prehistoric sequence.

The Pataya n cultural tradition is not well understood, but extends into the historic period when it is equated with speakers of Yuman languages. The Patayan tradition is divided into three phases, defined principally on the basis of changes in the Lower Colorado Buff Ware pottery that characterizes the tradition. This type of pottery is found throughout the Western Papaguería, being somewhat less common to the east where Hohokam ceramics predominate. It is unclear whether the occurrence of Lower Colorado Buff Ware implies the presence of Patayan groups in the Western Papaguería, or reflects contact and exchange between groups on the Lower Colorado and groups that occupied the Western Papaguería.

The Trincheras cultural tradition is best known from the Altar Valley in northern Sonora, where evidence for a subsistence base that included both agricultural production and wild resource procurement has been demonstrated throughout the cultural sequence. Trincheras Purple-on-red pottery is present on some sites within the Western Papaguería, indicating Trincheras groups may have used the region or were in contact with its inhabitants. Following the collapse of the Trincheras culture in the Altar Valley (the tradition was maintained further south), the area was occupied by Sopa O'odham and later by Tohono O'odham groups along with Spanish immigrants.

Early Historical Period

Evidence for use of the Western Papaguería during the Early Historical period is derived almost exclusively from ethnographic studies conducted during the late nineteenth and early twentieth centuries, as well as accounts of early Spanish explorers and missionaries. The Spaniards used the Western Papaguería principally as a travel corridor, following two primary routes—El Camino del Diablo that runs between Caborca and Yuma, and a north-south route that connected settlements in Mexico with the Gila Bend area.

The Spanish missionary Father Eusebio Kino traveled through the area in the late 1600s, and early 1700s noting that Tohono O'odham and Hia C-ed O'odham people occupied the Western Papaguería. Today O'odham groups claim affinity with the prehistoric Hohokam, but some

researchers have proposed that they also may have ties to the Patayan, while other researchers suggest that the O'odham are late emigrants to southern Arizona from northern Mexico (arriving after A.D. 1450). The Hopi also claim affinity with the prehistoric Hohokam based upon their history of migration of clans from an area south of the Hopi mesas. The Zuni have similar histories of migrations from southern Arizona.

The Cocopah, Quechan, Halchidoma, Cohuana, Halyikwamai, Kaveltcadom, Maricopa, and Mojave, who all spoke Yuman languages, occupied various areas along the Lower Colorado and Gila rivers, where they practiced floodwater farming during the Early Historical Period. Internecine warfare is documented to have led to frequent territorial shifts among these groups, but how these groups used the interior deserts of the Western Papaguería is unclear.

The Yavapai, who also spoke a related Yuman language, ranged through a vast territory north of the Gila River, relying primarily on hunting and gathering but also did some farming where water was available for irrigation. At times, the Yavapai probably ventured south of the Gila River into the Western Papaguería.

Apaches, who spoke Athapaskan languages, are also known to have made brief forays into the Western Papaguería, primarily to engage in raiding. Documents indicate Apaches were present at least by late seventeenth century, but how much earlier remains unclear.

Late Historical Period

Intensifying contact among American Indian groups and Euro-Americans characterized the Late Historical period in the Western Papaguería and surrounding areas. Less than three decades after winning its independence from Spain, Mexico lost the territory to the north of the Gila River to the United States at the end of the Mexican-American War in 1848. The United States acquired area to the south of the Gila River, which was home to the Hia C-ed and Tohono O'odham, through the Gadsden Purchase of 1853-1854.

In 1846, during the war with Mexico, U.S. troops first traveled along the Gila River, and three years later some 50,000 "Forty-Niners" followed on their way to the newly discovered gold fields of California. El Camino del Diablo served as an alternate route for some Forty-Niners, resulting in many deaths because of the scarcity of water along this southern passage. During the next century, various adventurers and scientists traveled along El Camino del Diablo.

By the Late Historical period, just the Cocopah and Quechan remained in residence along the lower Colorado River below the confluence with the Gila River, and no native groups resided on the lower Gila River. Remnants of several remnant Yuman speaking groups migrated east joining the Akimel O'odham (Pima) along the middle Gila River, where they became known as

the Maricopa. The extent to which the Cocopah and Quechan used the interior desert east of the Colorado River during this time period is not known.

The transcontinental Southern Pacific Railroad was constructed along the lower Gila River corridor during the Late Historical period, and copper mining at the New Cornelia Mine near Ajo stimulated construction of a spur line to connect with the Southern Pacific at Gila Bend. Gold was mined at the Fortuna Mine in the western part of the BMGR, and evidence for smaller mining and prospecting endeavors is reported throughout the region. From the late 1800s to the early 1900s, ranching and homesteading also were pursued in the area that was to become the BMGR.

World War II Period

The BMGR of today is the result of a series of land withdrawals that were initiated during World War II. In May 1941, when Lt. Col. Ennis Whitehead first surveyed the land west of Phoenix for Luke Field, he also noted that public lands south and west of Gila Bend were ideal for a gunnery range, and Luke student pilots began training on the range in September 1941. During World War II, pilots from both Luke Field and Williams Field used the eastern range for gunnery training, and pilots from the Yuma Army Air Base, which was established between 1941 and 1943, trained on the western range. After World War II when Luke Field was closed from 1946-1951, Williams Field personnel managed the eastern range. The Yuma Army Airfield became Vincent AFB in 1956 and then in 1959, MCAS Yuma.

Cold War Period

The Cold War period is defined as extending from the establishment of the “Iron Curtain” in Europe in 1946 to the fall of the Berlin Wall in 1989. Since 1951, the BMGR has hosted air-to-air and air-to-ground bombing and gunnery training on both manned and tactical ranges as part of the Cold War program of military preparedness. Today, Luke AFB operates three tactical ranges and four manned ranges within the eastern section of the BMGR. Most ordnance used on these ranges is inert (non-exploding), and use of live high-explosive ordnance is limited to five restricted locations. MCAS Yuma operates a simulated air-to-ground training range on the western section of the BMGR as well as two target areas where inert ordnance is used.

4.16.1.3 Cultural Resource Inventory

When the first cultural resource overview was prepared for the BMGR in the late 1970s, only 46 archaeological and historical sites had been recorded on the range (McClelland and Vogler

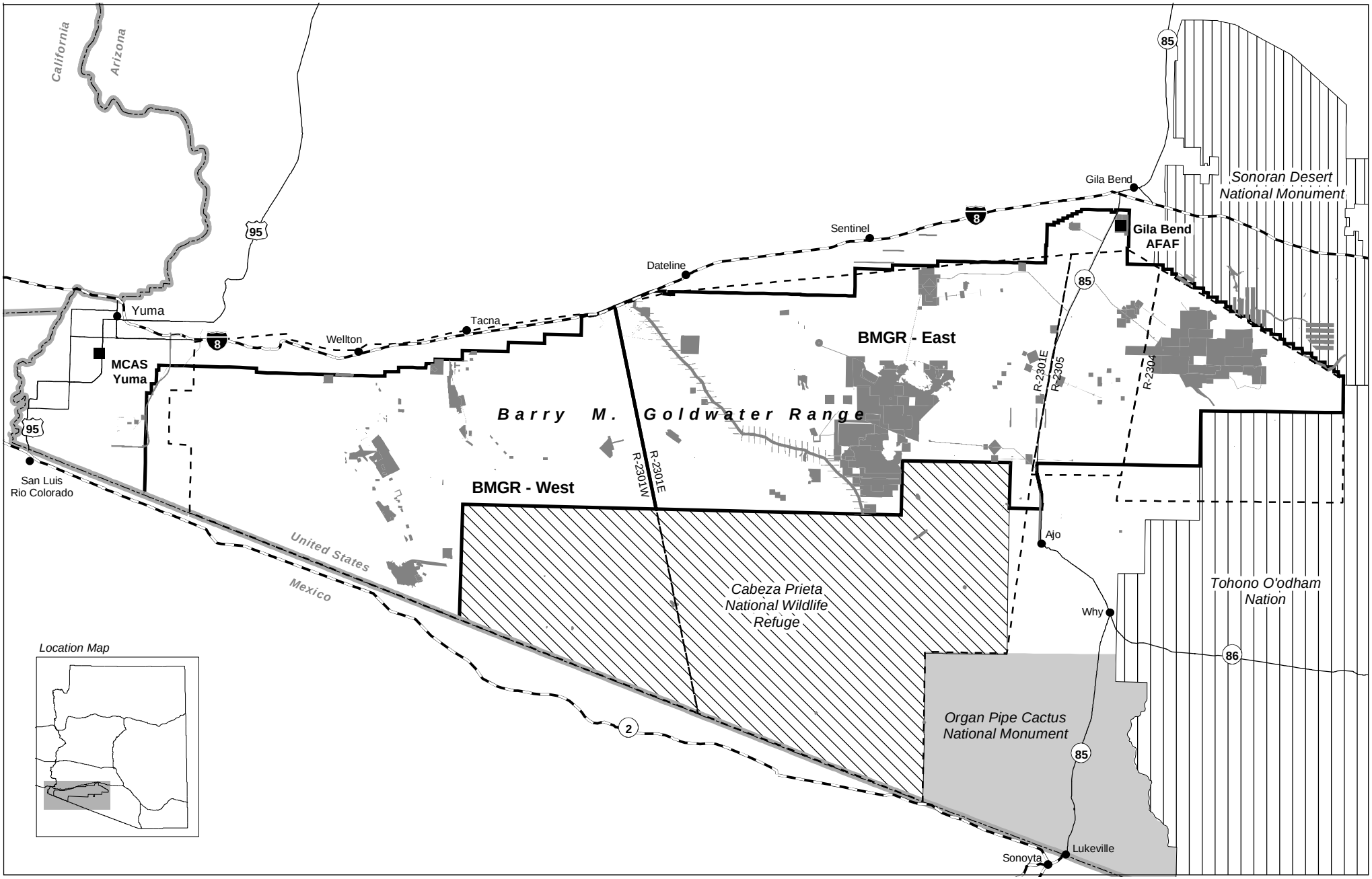
1977). A decade later, when a natural resources management plan was completed, the number of recorded sites had increased to 86 (Natural Resources Planning Team 1986). The most recent cultural resource overview reflects increased efforts by Luke AFB and MCAS Yuma to comply with new regulations and documents that 440 archaeological and historical resources had been recorded on the BMGR through 1995. (Forty-five of these sites are on the Cabeza Prieta NWR, which subsequently was eliminated from the BMGR, and approximately 30 sites are in other areas eliminated from the range.) An active program of survey has continued since 1995, and more than 900 archaeological and historical sites are now recorded on the BMGR. Luke AFB is developing a geographical information system database to facilitate management of these resources.

Areas that have been intensively surveyed for archaeological and historical sites are depicted on Figure 4-23. The total extent of systematic and intensive surveys (that is, within prescribed boundaries and walked at intervals of no more than 20 to 30 meters) is about 246 square miles, which is about 9 percent of the approximately 2,709 square miles within the BMGR (Table 4-36). In the aggregate, the surveys have resulted in the discovery of an average of about 3.8 archaeological and historical sites per square mile.

TABLE 4-36
SUMMARY OF ARCHAEOLOGICAL AND HISTORICAL SITES ON THE BMGR

Management Unit	Square Miles	Square Miles Surveyed	%	Recorded Sites
1	359.4	14.02	3.9%	42
2	414.1	23.78	5.7%	43
3	304.7	2.85	0.9%	18
4	437.5	17.03	3.9%	78
5	687.5	112.14	16.3%	422
6	215.6	4.92	2.3%	33
7	293.8	71.33	24.3%	304
Totals	**2,712.6**	**246.1**	**9.1%**	**940**

The results of the post-1995 surveys have not been reported in final form, but a summary of the surveys through 1995 provides a basis for characterizing the cultural resources recorded on the BMGR (Ahlstrom 2000:210-215). Many of the 395 archaeological and historical sites recorded on the BMGR (excluding the Cabeza Prieta NWR but including other areas subsequently eliminated from the range) through 1995 are recognized as having been occupied during distinct time periods. Sites that are occupied at different times may have more than one temporal component as represented by chronologically diagnostic artifacts or other traits that reflect different time periods or phases of occupation at a site. For example, a site might have been occupied during the Late Archaic period, as evidenced by distinctive types of flaked stone dart points, and again several centuries later, as occupied by Sacaton phase Hohokam pottery. Therefore, the number of temporal components can be considerably larger than the number of



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0 5 10 15 20

Scale in Miles

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Legend

- Restricted Airspace Boundary
- State Routes and other Highways
- U.S. Interstate and Mexico Federal Highways
- Intensive Cultural Resource Survey Area

Intensive Cultural Resource Survey Areas on the BMGR

Figure 4-23

sites, depending on how often sites were reoccupied. The archaeological and historical sites recorded on the BMGR represent 461 temporal components. Sixty-nine percent of the temporal components reflect aboriginal occupation of the region, about 23 percent reflect historic and recent uses of the BMGR, and the other 8 percent cannot be assigned to a temporal period.

Only 10 (2 percent) of the components represent the earliest Paleo-Indian period and all of these are identified as representing the Malpais or San Dieguito traditions. No sites of the Clovis or Folsom traditions have been recorded, although a few isolated fluted points characteristic of these traditions have been found on the BMGR or adjacent areas. Twenty-one (5 percent) of the components date from the subsequent Archaic era. In contrast, 211 components (46 percent) represent the subsequent Ceramic period and dominate the site inventory. Another 78 components (17 percent) represent American Indian sites that lack diagnostics and cannot be assigned to a specific period.

Ninety-six components (21 percent) reflect the historic Euro-American period use of the area. Another eight (2 percent) are related to the more recent Cold War era. Thirty-seven components (8 percent) cannot be dated.

There are a variety of features on the recorded sites. Features found on aboriginal sites include scatters of flaked or ground stone artifacts, quarries where toolstone was flaked, scatters of pottery sherds, bedrock grinding stones, thermal features (hearths, roasting pits, fire-cracked rock), middens (trash), clearings in desert pavement, aboveground architectural remnants, pit houses, and pictographs. Historic features found on Euro-American sites include mining features, structures and buildings, roads, ranching features, water features, trash features, cemeteries, and military facilities such as World War II auxiliary airfields. Features found on both aboriginal and Euroamerican sites include agricultural features (various rock alignments and accumulations), other rock features (circles, windbreaks, cairns), trails, petroglyphs (inscriptions), intaglios or geoglyphs (large ground designs made with rock alignments or by clearing desert pavement), and unmarked human graves. No historic human remains covered by the Native American Graves Protection and Repatriation Act have been found on the BMGR since the Act took effect in 1990.

Luke AFB also has consulted intensively with American Indian communities to address traditional cultural concerns and identify traditional cultural places that may warrant special management. Twenty-two of the 26 American Indian communities that Luke AFB consulted with indicated they had some level of interest in the cultural resources of the BMGR (Tisdale 2001). To date, Luke AFB has made arrangements for five of the groups to conduct their own ethnographic studies.

All of the consulted groups have concerns about treatment of any human remains that may be present in archaeological sites on the BMGR. Some communities consider the aboriginal

archaeological sites on the BMGR as having significant traditional cultural values beyond the archaeological information such sites may encapsulate. Some types of sites, such as petroglyphs, pictographs, intaglios, rock piles and trails affiliated with places that are identified as shrines or offering places, as well as archaeological sites associated with farming or trading of marine shell, have special traditional cultural values. Some places, such as the Gila Mountains, are considered significant because of associations with tribal origin accounts or other oral traditions.

In addition, springs, other sources of water, and plants or mineral deposits used for ceremonial, medicinal, and subsistence uses are considered traditionally important. One specific locality that many traditional cultural groups consider important is Tinajas Altas, a place along El Camino del Diablo where water could usually be found in a series of rock tanks. Past modification of tinajas for wildlife management purposes has disturbed associated archaeological sites. Environmental and cultural resource protection laws including NEPA and Section 106 of the NHPA now require that site-specific analysis of wildlife water development projects be conducted. Measures to avoid, minimize, or partially mitigate potential adverse impacts to cultural resources must be considered and implemented in consultation with Native Americans.

Many traditional cultural values are not focused on individual sites or places, but instead are more general concerns with entire landscapes. Luke AFB and MCAS Yuma will continue to consult with interested American Indian communities as an ICRMP for the BMGR is implemented.

Other historic resources on the BMGR that have been evaluated include 15 World War II period and 210 Cold War period buildings and structures at the Gila Bend AFAF (Keane and others 1997, 1998). Consultations concluded that none of these resources were eligible for the National Register. There are other military facilities dating from the Cold War throughout the BMGR, such as the ISST (Intercontinental Ballistic Missile Silo Superhardening Technology) Program test site, and the Buried Trench or Multiple Aim-point Validation (MAV) Project that was constructed in conjunction with evaluation of an alternate Intercontinental Ballistic Missile basing mode specific to the Missile Experiment. Stoval Auxiliary Airfield and other World War II auxiliary airfields have been determined eligible for the National Register. A Treatment Plan for these sites may be developed with the State Historic Preservation Office under the ICRMP.

An analysis completed in support of the renewal of the BMGR land withdrawal indicated that erosion or damage had degraded approximately 65 percent of the archaeological and historical sites recorded on the BMGR (U.S. Department of the Air Force 1999:3-105). Natural erosion was the source of degradation at half of the 394 affected sites. About 16 percent of the degraded sites had suffered from ORV traffic. Less than 3 percent had been intentionally vandalized, and less than 1 percent had been damaged by construction activities. The type of degradation at the other sites was not specified. The degree of damage and loss of integrity typically is not so severe that it has made sites ineligible for the National Register.

El Camino del Diablo, designated as site AZ X:7:3 (Arizona State Museum [ASM]), is the only property within the BMGR that is listed on the National Register. This important historic trail connected Caborca, Sonora, and Yuma, Arizona. The listed segment runs from Lukeville to Tinajas Altas at the base of the Tinajas Altas Mountains. The portion of the corridor on the BMGR (that is, outside the Cabeza Prieta NWR) has lost its historic integrity and is not considered a character-defining element of the historic trail. Portions of the trail north of Tinajas Altas are not included in the National Register listing.

Relatively few of the other cultural resources recorded on the BMGR have been formally evaluated for National Register eligibility. An analysis completed in support of the renewal of the BMGR land withdrawal indicated that consultation among federal agencies and the Arizona State Historic Preservation Office has resulted in consensus determinations about the eligibility of 62 resources or about 10 percent of the 605 recorded sites then available for analysis (U.S. Department of the Air Force 1999:3-107). Twenty-nine of these sites were determined to be eligible or potentially eligible, primarily under Criterion D. Consultations concluded that the other 33 resources were not eligible. This suggests that about half the resources on the BMGR may lack significant historic values, but the surveyors who recorded the 543 then inventoried but formally unevaluated sites had recommended that only 38 (7 percent) were not National Register eligible. This suggests that perhaps 90 percent or more of archaeological and historical sites on the BMGR are National Register eligible. Luke AFB and MCAS Yuma will continue to evaluate the eligibility of cultural resources in consultation with the State Historic Preservation Office and other interested parties as the ICRMP for the BMGR is implemented.

4.16.2 Interrelationship Between the Military Mission and Cultural Resources

As military use areas have been surveyed for cultural resources in recent years, the cultural sites found provide evidence that these sites were at least exposed to potential impact by military actions. In some cases, the sites found have been within EOD clearance areas or other military use areas, but not directly affected. In other instances, survey teams have recorded vehicle tracks, impact craters, and other types of disturbance.

Through the Section 106 review process, identified cultural resources will be evaluated for their eligibility for inclusion on the National Register, and the impacts of the mission on those resources will be assessed. Finally, measures to avoid, minimize, or partially mitigate those impacts will be considered and appropriate treatment measures will be implemented.

In other situations, cultural resources are affecting the military mission. The cultural surveys of military use areas have identified some situations where impacts of military activities on important cultural sites cannot be easily mitigated. For example, Target 209, a simulated

artillery target located in South TAC, was closed to military use when archaeologists found a large site that is now known as Verbena Village. As cultural surveys are completed for military use areas, other military features may also be closed to future use to protect and preserve the cultural remains.

Similarly, as new military operations and land uses are proposed, the areas affected will be surveyed for cultural resources before the military features are constructed at those sites. It is possible that cultural sites will be found and the military may choose to relocate the mission to another location to prevent impacts.

4.16.3 Existing Regulatory and Statutory Requirements and Management Plans and Actions

4.16.3.1 Regulatory and Statutory Requirements

All agencies with administrative or management responsibility for the BMGR are required to comply with applicable federal laws, and to the extent sovereign immunity has been waived, federal agencies are also required to comply with applicable state and local laws, including those related to cultural resources. The ICRMP describes 9 federal laws, 10 federal regulations, 3 Executive Orders and an Executive Memorandum, 6 federal guidelines, and 7 military directives, instructions, policies, instructions and manuals related to management of cultural resources. Some of the primary laws, regulations, Executive Orders, and policy guides that are applicable to cultural resources are summarized below:

- **National Historic Preservation Act of 1966 as amended (16 USC 470 *et seq*.).** This is the cornerstone of the current federal cultural resource program. The Act established the National Register of Historic Places and Section 106 requires federal agencies to consider effects of their undertakings on cultural resources on or eligible for the National Register. Section 110 of the Act directs federal agencies to assume responsibility for the preservation of National Register listed or eligible historic properties owned or controlled by their agency. It directs federal agencies to locate, inventory and nominate properties to the National Register, to exercise caution to protect such properties, and to use such properties to the maximum extent feasible. The Act is implemented by regulations for Protection of Historic Properties (36 CFR Part 800).

- **Native American Graves Protection and Repatriation Act (1990) (25 USC 3001-3013).** This law protects human remains of indigenous peoples and funerary objects, sacred objects, and items of cultural patrimony found on, or taken from, federal or tribal

lands. The Act also provides for repatriation of such human remains and cultural items controlled by federal agencies or museums receiving federal funds.

- **Archeological Resources Protection Act of 1979 (16 USC 470aa-470mm).** This law strengthened protection of archaeological resources on federal and tribal lands by increasing penalties for unauthorized excavation, collection, or damage. The Act and implementing regulations (36 CFR Part 229) stipulate that agencies require permits for excavation of resources protected by the Act and that affiliated tribes be notified about archaeological investigations conducted under such permits. The Act also directs agencies to not disclose information about archaeological resources without first determining that release of such information will not risk or increase the risk of harm to the resource. Implementing regulations also stipulate that agencies (a) develop plans for surveying lands under their control to determine the nature and extent of archeological resources on those lands; (b) prepare a schedule for surveying lands that are likely to contain the most scientifically valuable archeological resources; and, (c) implement a system for recording and reporting ARPA violations. Federal agencies also are required to develop public awareness programs. Regulations for Curation of Federally-Owned and Administered Archaeological Collections, 36 CFR Part 79, define standards for preserving collections made in accordance with this and other federal laws.

- **American Indian Religious Freedom Act (1978) (42 USC 1996).** This law states that it is the policy of the United States to protect and preserve for American Indians their inherent right of freedom to believe, express, and exercise their traditional religions including but not limited to access to sites, use and possession of sacred objects, and the freedom to worship through ceremonial and traditional rites.

- **Executive Order 13007 (1996).** This Executive Order on Indian sacred sites directs agencies responsible for managing federal lands to "(1) accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners and (2) avoid adversely affecting the physical integrity of such sacred sites. Where appropriate, agencies shall maintain the confidentiality of sacred sites." The order also requires that reasonable notice be given for proposed actions or policies potentially restricting access to, or adversely affecting, sacred sites.

- **Executive Memorandum, 29 April 1994, Government-to-Government Relations with Native American Tribal Governments.** This memorandum directs each executive department and agency to operate within a government-to-government relationship with federally recognized tribal governments; consult with tribal governments prior to taking actions affecting such governments; and assess the impact of plans, projects, programs and activities on tribal trust resources and assure that tribal rights are considered during formulation of such plans, projects, and programs.

- **Air Force Manual 126-5, Natural Resources, Outdoor Recreation, and Cultural Values.** This manual provides guidance, standards, and technical information on management of natural resources, outdoor recreational resources, and cultural resources.

- **AFI 32-7065 Cultural Resources Management.** This Air Force Instruction implements DoD Directive 4710.1 and Air Force Policy Directive 32-70, *Environmental Quality*. The guidance is comprehensive and addresses preparation of cultural resource management plans, inventory and evaluations of cultural resources, and procedures for consulting with State Historic Preservation Offices, the Advisory Council on Historic Preservation, and other interested parties.

- **Marine Corps Order P5090.2A, Chapter 8, Historic and Archaeological Resources Protection.** Marine Corps Order P5090.2A, *Environmental Compliance and Protection Manual*, provides guidance and instruction to installations enabling them to meet stringent environmental legislation and increasing pressure by regulatory agencies at the federal, state, and local level. Chapter 8, Historic and Archaeological Resources Protection, establishes Marine Corps policy and responsibilities for compliance with statutory requirements to protect historic and archaeological resources. This chapter addresses Marine Corps installation requirements for the development and implementation of an historic and archaeological resources protection program, in accordance with the specifications of the NHPA and ARPA. The material covered conforms with DoD specifications, which provide procedures for the management of archaeological and historic resources under DoD control.

4.16.3.2 Lower Gila South RMP (Goldwater Amendment)

The Lower Gila South RMP (Goldwater Amendment) includes the following management actions for cultural resources:

1. Prepare a Cultural Resource Management Plan.

2. Conduct cultural resource inventories prior to initiating BLM sponsored projects and act as lead agency for Section 106 compliance on BLM sponsored projects.

An ICRMP is currently being prepared that will replace the BLM's Cultural Resource Management Plan. With the passage of the MLWA of 1999, BLM no longer has the responsibilities for sponsoring management projects on the BMGR. Consequently, the actions identified in this existing plan will soon be obsolete.

4.16.3.3 Integrated Cultural Resources Management Plan

While this EIS includes an assessment of how the plan might affect cultural resources, it does not address how cultural resources on the BMGR are to be managed. A separate ICRMP is currently being prepared to address this. The following preliminary goals have been defined to guide that plan:

Goal 1. Conflicts between resource protection and mission needs are minimized.

Goal 2. Cultural resources are routinely considered by cooperating agencies as a part of project planning and design, for all activities on BMGR.

Goal 3. Cultural resources on BMGR are preserved in place to the fullest extent possible.

Goal 4. Cultural resources on BMGR are identified, and evaluated (as consistent with Air Force and Marine Corps guidance) for the National Register of Historic Places.

Goal 5. Input from Native American tribes and groups that attach cultural significance to places on BMGR will be encouraged to the fullest extent possible.

Goal 6. Native American concerns for heritage resources (both natural and cultural) are identified and addressed, and Native Americans have access to heritage resources to the maximum degree consistent with Air Force/Marine Corps mission requirements.

Goal 7. Research involving places on or materials and information collected from BMGR is of the highest professional quality.

Goal 8. Native Americans, archaeologists, and the general public benefit from and have access to information about cultural resources on BMGR to the extent consistent with Air Force and Marine Corps responsibilities for resource protection and public education and outreach.

4.16.4 Information Not Currently Available to Support Cultural Resource Management

The current lack of some data or information poses potential challenges for the future management of cultural resources within the BMGR. This currently unavailable information was identified during the preparation of the affected environment section of this EIS. It does not constitute incomplete or unavailable information needed to conduct the environmental impact

analysis presented in Chapter 5 in accordance with 40 CFR §1502.22. The forthcoming ICRMP will fill important management information needs by providing direction for how cultural resources will be managed by DoD, particularly during the 25-year period in which the BMGR may remain withdrawn as a military reservation per the MLWA of 1999. Although additional cultural resources information needs may be defined in the future, those identified in this document include:

- *Recreation Use Effects.* The largest remaining unavailable cultural resources management data is the lack of information about recreational impacts on these resources. In some locations, such as Tinajas Altas, some of the impacts to cultural resources resulting from recreation use and other activities have been documented (Thurtle and others 2000). However, there is no specific quantified information on how dispersed recreational use (including roadside camping, rockhounding, illicit ORV travel, recreational shooting, etc.) affects cultural resources on the BMGR.

- *Wildlife Water Development Impacts.* Many of the developed wildlife waters within the BMGR were naturally occurring water sources that have been modified by construction that occurred prior to the passage of today's environmental and cultural resource protection laws. These water sources, which are important to game species today, were also critical resources for human users of the area through time, and cultural resources are commonly associated with these sites. Available water was a key component of how the area was used in the past and whether or not people stayed there year-round, for extended "seasons," or moved from place to place frequently. There is no information as to the cultural resource effects that occurred when most of the existing wildlife water developments were constructed. There is also no information on how the aggregate distribution of naturally occurring surface waters affected broader land use patterns such as in establishing trade and travel routes across the greater BMGR area.

- *Related to Geological Resources*. Geomorphic mapping (i.e., of the form and evolution of both ancient and present-day landscapes) could provide data that could assist with identification of potential surface and buried cultural resource sites. The potential effects to cultural resources from subsidence (such as has been observed in the Growler Wash area of South TAC) and accelerated erosion could be better understood through assessment and/or mapping. Rockhounding could have impacts to rock and mineral sources that are archeological sites (e.g., obsidian and geode sources).

4.17 VISUAL RESOURCES

4.17.1 Existing Conditions

4.17.1.1 Introduction

The BMGR typifies the general landscape characteristics of the Sonoran Desert with expansive mountain ranges and relatively flat basins. Interspersed elements of visual interest include diverse flora and fauna and unique geologic features that add variety to the landscape. Despite more than 60 years of military training on the BMGR, the majority of the range landscape has remained in its natural state. The withdrawal and reservation of the range have precluded public land uses such as mining, livestock grazing, agriculture, and intensive recreation that could potentially modify natural landscapes. Military modifications to the landscape include roads, vehicle tracks from ORV use, target simulations, observation towers, ordnance delivery impacts, auxiliary airfields, instrumentation sites, and support areas for military training. These military modifications are generally subordinate elements in the range landscape.

The visual resource study area includes the eastern and western portions of the BMGR and adjacent locations where the range is likely to be viewed, including major travel routes such as State Route 85 and Interstate 8 as well as the communities of Ajo, Gila Bend, and Yuma. However, aside from incidental viewing of the range from travel routes such as State Route 85 and Interstate 8, opportunities for the public to view the eastern and western sections of the BMGR are limited. As explained in Section 4.12 Outdoor Recreation, the BMGR is accessible for public recreation use subject to the constraints of the overriding military training mission for which the range was established.

4.17.1.2 Overview of Existing Conditions

During preparation of the Renewal of the Barry M. Goldwater Range Land Withdrawal LEIS, a study was conducted using the BLM 8400 series Visual Resource Management (VRM) manual as a basis.

The BLM VRM system classes establish visual management objectives on public lands following the evaluation of three primary elements: scenic quality (i.e., landscape aesthetics), visibility, and visual sensitivity. Management Classes (I to IV) are used to classify lands according to visual resource management goals. (Management Classes I and II have a special designation applied to wilderness areas, wilderness study areas, some natural areas, and other areas where the management policy or legislative mandate is to restrict changes to the natural landscape.)

Scenic Quality

During preparation of the BMGR LEIS, the VRM system was used to determine scenic quality of the BMGR. Landscape features such as landform, vegetation, color, and manmade changes were evaluated. The system classifies scenic quality as either Class A, Class B, or Class C, depending on the diversity of the landscape (Table 4-37). Landscapes with a greater diversity of features typically have a greater aesthetic appeal and, therefore, high scenic quality.

TABLE 4-37 BLM'S SCENIC QUALITY CLASS DEFINITIONS
Class A Outstanding areas where characteristic features of landform, rock, water, and vegetation are distinctive or unique in the context of the surrounding region. These features exhibit considerable variety in form, line, color, and texture.
Class B Above average areas in which features provide variety in form, line, color, and texture. Although the combinations are not rare in the surrounding region, they provide sufficient visual diversity to be considered moderately distinctive.
Class C Common areas where characteristic features have little variation in form, line, color, or texture in relation to the surrounding region.

Of the BMGR area included in the analysis (1,842,423 acres at the time), approximately 54 percent of the area was found to have Class C scenic quality, about 35 percent of the area was found to have Class A scenic quality, and about 11 percent of the area was found to have Class B scenic quality. Class A landscapes were found to consist largely of mountain ranges characterized by dominant ridge lines, rock outcrops, and a variety of slopes ranging from smooth and rounded to steep and eroded. Class A landscapes included the Sand Tank Mountain basins; Mohawk Sand Dunes; the San Cristobal Wash; and the following mountain ranges: Sand Tank, Sauceda, Crater Range, Growler, Aguila, Granite, Mohawk, Copper, Tinajas Altas, and the Gilas.

Class B landscapes were found to consist of flat to rolling terrain with unique vegetation such as saguaro and ocotillo dispersed throughout. Some Class B landscapes are dissected by larger washes exhibiting ribbons of dense vegetation and/or by smaller isolated mountains. Class B landscapes included Childs Mountain, Baker Peaks, and the Lechuguilla Desert.

Class C landscapes were found to be characterized by relatively flat terrain interspersed with low to moderate density desertscrub vegetation. These landscapes included the valley area southeast of Gila Bend between the Sauceda Mountains and Sand Tank Mountains, Childs Valley, San Cristobal Valley, and Mohawk Valley.

Viewpoints, Visibility, and Visual Sensitivity

Viewpoints

Evaluation of viewpoints or key observation points that characterize the current visual environment included the following:

Travel Routes and Rest Stops—roads, highways, and recreation destination roads and their associated rest stops, El Camino del Diablo, and other recreation travel routes

Special Recreation, Conservation, and Preservation areas—designated for special recreation, conservation, or preservation with limited public access including Tinajas Altas Mountains ACEC, Mohawk Mountains and Sand Dunes ACEC, and Air Force Management Area B

Other Popular Recreation Areas—the Baker Tanks Pavilion and Fortuna Mine areas

Military Use Areas—selected sites with modifications including areas with limited and/or restricted public access

Residences/Communities—primary or recreational residences, trailer parks, and recreational vehicle parks adjacent to the BMGR boundary

Visibility and Visual Sensitivity

Viewsheds (seen areas and distance zones) were determined for each of the viewpoints identified. Seen areas represent the visible portion of a viewshed determined by the degree of screening present or absent. Screening results from terrain and vegetation or a combination of these two elements. Screening is described as open (no obstructed view), partially screened (obscured view), and screened (fully obstructed view). Distance zones represent how perceptions of landscape elements within a particular viewshed change with increasing distance from a viewpoint. With increasing distance, form, line, color, and texture tend to become less obvious and visible details diminish. For the BMGR visual resource analysis, the following distance zones were established: foreground (0 to 1 mile), middleground (1 to 3 miles), and background (3 miles to horizon). In foreground distance zones, details are perceived and obvious and textural and color qualities are normally perceived. In the middleground distance zone, details cease to be perceptible and dominant elements begin to appear as outlines or patterns. In the background distance zone, landform becomes the dominant visible element.

The BLM VRM system defines visual sensitivity as a measure of viewer concern for the scenic resource and potential changes to the resource. Factors that were considered when determining overall visual sensitivity of each viewpoint on the BMGR included user volume/public access,

agency management concern, interrelationships with adjacent land uses, and viewing duration. Each of these factors was assigned a value of high, moderate, or low and a final overall sensitivity level was assigned to each viewpoint.

The results of the sensitivity level analysis suggest that all inventory viewpoints with the exceptions of target ranges and AUX-2 have high or moderate sensitivities. However, many of the viewpoints studied were selected based on their potential to have high sensitivity levels.

Because the largest number of people view the range from Interstate 8 or State Route 85, all rest area viewpoints along these highways and all other viewpoints along State Route 85 were assigned high sensitivities. The majority of persons traveling on the highways, however, likely have a lower level of concern for change in the landscape than the lower volume of persons who visit the range. Without conducting a detailed analysis of user attitude, these user sensitivities cannot be determined. However, unlike highway travelers or adjacent residential areas, visitors to the range are aware of the military context of the range. Therefore, military modifications are often expected.

Travel Routes and Rest Stops

All of the portion of State Route 85 from Gila Bend to Ajo was determined to be a high sensitivity viewpoint. Views of the BMGR from this highway and the two roadside stops between Gila Bend and Ajo are primarily open and panoramic due to the relatively flat terrain and low vegetation. However, there are occasional areas where views of the range are screened (restricted) due to the presence of terrain (for example, the Crater Range). Some military modifications can be viewed along this highway such as the range perimeter fencing, gate signs, distant manned range towers, and equipment sites located on mountaintops. These modifications are generally not easily recognized nor are they dominant features in the landscape. At times, military aircraft operations are visible from the highway, particularly aircraft in low-level flight that are preparing to strafe or bomb manned range targets and in night operations involving flares that light the night sky. The cloud of dust that results from a large net explosive weight munitions delivery to East TAC HE Hill can also be seen from State Route 85. These aircraft and dirt plumes introduce temporary and transient visual impacts. Non-military modifications along this highway include a 69kV transmission line; the Tucson, Cornelia and Gila Bend Railroad; the BMGR perimeter fence; and roadside stops with shelters and trash receptacles.

With the exception of rest areas near Sentinel and Dateland, which are high sensitivity viewpoints, Interstate 8 is a moderate sensitivity viewpoint. Views of the BMGR from this route are relatively open and panoramic, except for areas in the Mohawk and Gila mountains where terrain screens the views. Undisturbed foreground and middleground views of the BMGR from the interstate exist south of Sentinel and south of Dateland including views from highway rest areas. The former MAV test site is evident in background views from the highway east of the

Mohawk Mountains. Although not easily recognized, views of the communication facilities on Baker Peaks exist along the interstate south of Tacna. Non-military modifications along this route include several communities, rural residences and ranches, interchanges, fences, and the Union Pacific Railroad.

Secondary travel routes found within the BMGR are primarily located in valley or desert settings and are usually accessed from a main off-range road. High sensitivity views along these routes exist wherever military use occurs along a principal recreation travel corridor. The best example of this is along El Camino del Diablo east. Areas of cleared vegetation and vehicle tracks are evident in troop deployment areas located adjacent to the road corridor. Foreground views of bunkers, communication facilities, and electrical distribution lines are also found along El Camino del Diablo east of the TACTS range main airfield and Intercontinental Ballistic Missile Silo Superhardening Technology site.

Special Recreation, Conservation, and Preservation Areas

High sensitivity views within areas designated as special recreation, conservation, and/or preservation areas, as depicted on Figure 4-19, include the following:

Air Force Management Area B—views of this area range from foreground to background. Backdrop views of Sonoran Desert upland landscapes are undisturbed (with upper bajada views in the foreground), except for recreation travel routes and historic mining and well sites that add visual interest.

The Coffeepot Mountain area, located south of the southeast corner of Area B, is of visual interest and the Sonoran desertscrub community in this area is diverse.

Crater Range SRMA—from State Route 85, views of the Crater Range are predominantly foreground. Views of this scenic landscape are open along the outer edge of the mountains and are restricted by the rugged terrain within the mountains. Visible modifications include the highway, signs, and a 69kV transmission line. Some graffiti has also been painted on or carved into some of the rock faces.

Sentinel Plain Lava Flow SRMA—foreground to background views from roads passing through the area are open and panoramic. These foreground and middleground views are undisturbed. Public access is not allowed.

Mohawk Mountains and Sand Dunes ACEC—foreground and occasional middleground views from two-track roads within this ACEC are high sensitivity views. Views are undisturbed with the exception of a TACTS range instrumentation site, one main recreation road, and DARTs near the eastern side of the mountains.

Tinajas Altas Mountains ACEC—foreground views are primarily concentrated along El Camino del Diablo and the main ACEC circulation route. Disturbance to vegetation and soils is evident within this landscape as a result of multiple two-track roads.

Childs Mountain watchable wildlife overlook—foreground and background views from upper elevations are open and panoramic, offering exceptional viewing opportunities and unique views of the Cabeza Prieta NWR. From Childs Mountain, visible modifications within the BMGR include middleground to background views of target areas and facilities located at Manned Range 1. Foreground views into the Cabeza Prieta NWR portion of the BMGR include communications facilities at the top of Childs Mountain with pristine wilderness backdrops.

Other Popular Recreation Areas

Views from the Baker Tanks and pavilion area were considered of moderate sensitivity. The views are open and panoramic. Modifications within the foreground include the pavilion (an open stone building with benches, a fire pit, barbecue area, and garbage cans) and a range identification sign posted along the road that enters interior locations of BMGR—West. The TACTS range master tracking facilities, located on Baker Peaks to the east, are evident in background views from the recreation area. In addition, there are several two-track roads associated with the TACTS range master tracking facilities that are visible from the Baker Tanks pavilion. Disturbed soils along these roads contrast sharply with the adjacent darker colored soils and therefore increases their visibility within this landscape.

High sensitivity views of the range from Fortuna Mine are largely restricted to the foreground due to the surrounding terrain. Remnants of historic mining activities are evident but not dominant features within this landscape. Although ORV use is prohibited on the BMGR, concentrated areas of soil disturbance from vehicle tracks is apparent in the vicinity of Fortuna Mine, particularly in the rounded foothills of the Gila Mountains, extending from the Fortuna Mine area to the community of Foothills.

Military Use Areas

Military use areas within the BMGR have variable viewing conditions associated with use. These views were primarily in the foreground and are considered low sensitivity views due to the existing level of modification and restrictions placed on public access.

Foreground views of modifications from roads within the tactical ranges are primarily screened due to the presence of vegetation. Visible modifications include targets, Television Ordnance Scoring System (TOSS) towers, observation areas, munitions debris, target access roads, and off-

road tire tracks from EOD activities. Within target areas, these modifications are dominant features within this landscape; however, outside of target areas the modifications become subordinate to the natural landscape.

Foreground views from manned ranges are generally open, but occasionally screened due to the presence of vegetation. Visible modifications (including towers, target areas, and two-track roads) dominate the landscape setting.

There is limited public access at the Gila Bend AFAF. Foreground views are dominated by the presence of several buildings, paved roadways, signs, lights, vehicles, and an airfield. Views from the perimeter boundaries of this area are open and panoramic extending into the middleground and background.

Foreground and middleground views underlying the air-to-air range complex are generally open, and partially screened due to the presence of vegetation. DARTs (12-foot simulated airplane targets formerly used in air-to-air training) are visible throughout this area. Due to the aerodynamics of the DART, targets tend to land nose-first with enough impact to bury the nose of the target and cause the DART to remain standing for many years. Because the color and form of the DARTs contrast with the natural landscape, DARTs can be highly visible features within the landscape setting. Some DARTs are visible from major travel routes within the Cabeza Prieta NWR and Wilderness. The largest concentration of the DARTs on the range is in the San Cristobal Valley, just north of the Cabeza Prieta NWR. Here, many DARTs are visible in the foreground and middleground and the DARTs are dominant features in the landscape.

Views within the Moving Sands/Cactus West target facilities are relatively open and panoramic and range from foreground to background conditions. Visible modifications include the Cannon Air Defense Complex, the rifle and pistol range near Yuma, AUX-2, a paved road, and target areas. Of these areas, the Cannon Air Defense Complex and AUX-2 facilities are dominant features in the foreground and middleground views.

Residences and Communities

There are several areas of dispersed residences and communities adjacent to the BMGR where range modifications and activities are visible in the foreground to background. These views from residential areas are considered high sensitivity views and have variable viewing conditions. From residences on the southern edge of Gila Bend, views of the Gila Bend AFAF are in the middleground. The airport beacon at Gila Bend AFAF is evident, but is not a dominant feature in the viewshed.

Foreground to background views into the BMGR from Sentinel, Dateland, Tacna, and Wellton as well as dispersed residences located between these communities appear undisturbed. With the

exception of aircraft operations, range activities or use areas are located far enough from these residences so they are not visible. Middleground and background views from residences in Ajo vary from open to screened due to the presence of buildings, terrain, and vegetation near Ajo.

Views into the BMGR from residences along the southeastern edge of Yuma are predominantly open in the foreground, with some views extending into the background. Visible modifications in the foreground primarily include facilities at the Cannon Air Defense Complex and the rifle range as well as trespass off-highway vehicle and four-wheel drive tracks from the Foothills/County 14 area. These facilities dominate views into the BMGR due to their size and height.

4.17.2 Interrelationship Between the Military Mission and Visual Resources

Although military use of the BMGR affects views from some viewpoints, these manmade changes are not dominant, do not attract attention, and do not affect the overall scenic quality of the BMGR. Because of military operations, appropriative land uses such as mining and livestock grazing are precluded within the BMGR. This situation has thus preserved much of the visual integrity of the area.

While the military strives to maintain visual integrity in selecting locations for required facilities, visual resource considerations would not preclude the development of new military facilities nor operational activities.

4.17.3 Existing Regulatory and Statutory Requirements and Management Plans and Actions

The visual resource management policies that have historically been applied to the BMGR have been compatible with the BLM's VRM system. A visual resources inventory of the BMGR was conducted for the range renewal LEIS (U.S. Air Force 1999) using the BLM 8400 series VRM manual, which is described below. In contrast to the BLM, the DoD does not have specific guidelines in place for management of visual resources.

4.17.3.1 Bureau of Land Management—Manual 8400, Visual Resource Management

The objective of BLM's VRM is to manage public lands in a manner that will protect the quality of the scenic (visual) values of these lands. The VRM system provides a means to identify visual values, establish objectives through the RMP process for managing these values, and provide timely inputs into proposed surface disturbing projects to ensure that these objectives are met.

Although assigning values to visual resources is a subjective process, the BLM has utilized the basic design elements of form, line, color, and texture to describe and evaluate landscapes. These basic design elements and concepts have been incorporated into the VRM system to lend objectivity, integrity, and consistency to the process. The VRM system is designed to compare each part against the other in order to identify those parts that are not in harmony. Then, ways are sought to bring them back into harmony. The information generated through the VRM system is to be used as a guide. The field manager decides the amount of visual change that is acceptable (U.S. DOI, BLM 2001h).

Visual values are identified though the VRM inventory (Manual Section 8410) and are considered with other resource values in the RMP process. Visual management objectives are established in RMPs in conformance with the land use allocations made in the plan. These area-specific objectives provide the standards for planning, designing, and evaluating future management projects.

The contrast rating system (Manual Section 8413) provides a systematic means to evaluate proposed projects and determine whether these projects conform to the approved VRM objectives. It also provides a means to identify mitigating measures that can be taken to minimize visual adverse impacts.

4.17.3.2 Bureau of Land Management Final Lower Gila South Resource Management Plan (Goldwater Amendment)

The BLM 1990 Lower Gila South Resource Management Plan (Goldwater Amendment) was the BLM's land use management plan for the BMGR. The plan establishes methods for managing visual resources as well as the non-military road network and vehicle use, outdoor recreation use, and wildfire management.

The management objective for visual resources, as presented in the Goldwater Amendment, is as follows:

- Establish and maintain visual resource conditions...through the application of BLM visual resource management principles on authorized activities. In most instances, specific management plans and activity planning will be used to inventory, delineate and map specific visual management classes. Until these plans and visual inventory/mapping are completed, areas would be managed under interim designations considered appropriate and addressed under the [Luke Air Force Range] Plan (Section 9.4 Visual Resources).

- All other areas not specifically addressed by this plan or the [Luke Air Force Range] Plan will be considered Class 3 visual management areas for visual resource management purposes."

- Under the Goldwater Amendment, interim visual resource management classes were established for ACECs, mountain ranges, recreation travel corridors, the San Cristobal Valley, and target range areas.

Other specific management actions prescribed by the Goldwater Amendment include:

- control excessive fugitive dust at BLM-permitted construction sites and recreation activity areas

- protect mountain vistas from visual intrusions by developing, during site or project specific activity planning, visual resource management prescriptions needed to maintain appropriate visual resource management objectives protect the visual resource quality on lands adjacent to El Camino del Diablo and highways (Interstate 8 and State Route 85)

- lessen, prevent or mitigate further degradation of visual and scenic resources...by assisting U.S. Air Force and U.S. Marine Corps military and environmental planners on the siting of future military training activities.

- use of existing disturbed and impacted land areas for new training activities should be utilized wherever possible

- assist, if requested,...military and environmental planners on future plans for developing removal methods for errant tow targets in order to minimize or avoid damage to natural and cultural resources

- monitor air quality trends

Many of the above management actions for the Goldwater Amendment originate in the 1986 Luke Air Force Range Plan, developed by the University of Arizona for the U.S. Air Force.

4.17.4 Information Not Currently Available to Support Visual Resource Management

No specific shortfalls in existing data or information that would pose potential challenges for the future management of visual resources within the BMGR were identified during the preparation of the affected environment section of this EIS.

4.18 HAZARDOUS MATERIALS AND WASTES

Military operations conducted on the BMGR sometimes require the use of materials and resulting wastes that, under certain circumstances, may be hazardous to human health or the environment. To protect against those hazards, there are numerous state and federal laws regulating the use, storage, transportation, handling, and disposal of hazardous materials and wastes. Practices at the range must conform to these rules and regulations as well as a host of additional Air Force and Marine Corps policies and practices aimed at preventing pollution. These Air Force and Marine Corps pollution prevention policies strive to meet or exceed all regulatory requirements, minimize or eliminate hazardous materials use, and prevent the release of hazardous materials into the environment.

Chief among the statutory compliance requirements is the RCRA. The primary goals of RCRA are to protect human health and the environment from the potential hazards of waste disposal, to conserve energy and natural resources, to reduce the amount of waste generated, and to ensure that wastes are managed in an environmentally sound manner. To achieve these goals, RCRA established three interrelated programs: the solid waste program under Subtitle D, the hazardous waste program under Subtitle C, and the hazardous substances and petroleum product underground storage tank (UST) program under Subtitle I. As required by RCRA, EPA developed a comprehensive set of implementing regulations, which can be found at 40 CFR 240-282.

4.18.1 Existing Conditions

Hazardous materials and waste management on the BMGR generally falls into the following four topic categories, which are elaborated upon in this subsection: (1) hazardous materials, (2) hazardous and solid wastes, (3) military munitions and military munitions waste, and (4) formerly contaminated sites.

4.18.1.1 Hazardous Materials

Hazardous materials stored, transported, and/or used on the BMGR to support the military mission include petroleum, oils, and lubricants (POLs); various paints, thinners and cleaning solvents; and pesticides and herbicides. In general, most POLs, paints, cleaning solvents, pesticides, and herbicides used by the military occurs at the developed range administration and support facilities including the Gila Bend AFAF, Marine Corps' Cannon Air Defense Complex, and manned range control towers for facility maintenance and operation. Three active petroleum product USTs that meet all applicable management and compliance requirements are located at the Gila Bend AFAF for fuel storage (Rothrock 2001).

In dispersed locations throughout the range, latex paints are used for construction and repair of simulated targets. In addition, during troop deployment and range maintenance and clearance activities, POLs are used to power and maintain vehicles and portable generators in the target ranges and ground support areas throughout the BMGR. To avoid soil contamination and contain inadvertent spills of fluid, temporary containment aprons made of high-density sheeting and sandbags are placed beneath parked vehicles, supply drums, temporary aboveground storage tanks, fuel tankers, vehicles being fueled, and other stationary equipment that may leak fuels or lubricants such as generators. Maintenance of these containment aprons is controlled by the field units. When soiled, they are placed in secure containers, transported off-range, and handled/treated/disposed of as solid waste in accordance with applicable rules and regulations. The various plans, programs, and protocols in place for managing military use of hazardous materials are further discussed in Section 4.18.3.

Recreational users of the BMGR also use an unknown amount of POLs to power their vehicles and other motorized equipment.

4.18.1.2 Hazardous and Solid Wastes

Hazardous wastes are products or by-products of hazardous materials. In order to be classified as hazardous, wastes must either appear on a series of lists compiled by the EPA or demonstrate the characteristics of ignitability, corrosivity, reactivity, or toxicity. Solid wastes include garbage; refuse; sludge (from a wastewater treatment plant, water supply treatment plant, or air pollution control facility); and other discarded material including solid, liquid, semi-solid, and contained gaseous materials resulting from industrial, commercial, mining, and agricultural operations.

The potential areas for both hazardous and non-hazardous waste generation on the BMGR are parallel to those hazardous materials use areas described previously. In addition, when military aircraft mishaps involve the downing of an aircraft, hazardous wastes typically are generated. The protocol for responding to an aircraft crash includes multiple considerations for hazardous materials and waste management at a crash site to include an estimate of the environmental damage to the site as compared to the derived benefits from the removal operation or site mitigation measures. This and other hazardous waste management programs and protocols in place on the BMGR are detailed in Section 4.18.3.

Routine military waste management on the BMGR is currently accomplished by means of wastewater treatment lagoons at the Gila Bend AFAF, septic systems at other established support facilities, and the regular removal of all other hazardous and solid wastes from the BMGR for recycling or disposal in approved off-range landfills. Low concentrations of hazardous wastes may be processed in the wastewater treatment lagoons and septic systems. These sites are monitored in accordance with applicable regulations to ensure that undue amounts of hazardous wastes are not released into the environment.

During military troop deployment exercises on the range, all solid waste is collected, contained, transported off range, and disposed of in accordance with all applicable rules and regulations. Human sewage at base camps and other locations of troop concentrations is contained in portable toilets and removed by a commercial contractor to approved sewage treatment facilities. All solid waste is policed and contained daily to be carried off the range to approved landfill sites. One exception to this is the WTI waste management program. WTI, a training course that occurs twice a year for approximately six weeks at a time, is of large enough scale to produce additional organic wastes. During WTI, hazardous waste and petroleum products are managed in accordance with MCAS Station Order 6280.3E, *Hazardous Waste Management Standard Operating Procedure.* Greywater and cooking residues are deposited on the ground or into a pit dug for that purpose. As with troop deployment exercises of shorter duration, human sewage is also contained in portable toilets and transported off the range to an approved sewage treatment facility by means of a commercial contractor (Pearce 2001b).

The management of non-military waste on the BMGR is largely limited to the current recreation user code of conduct, which is communicated via the permit program. According to this code, visitors are asked to observe a "minimal impact" camping policy to ensure protection of the natural resources on the range. When breaking camp, campers are asked to remove all traces of human visitation and to smooth out tire tracks in the camp area. It is suggested that a garden rake be packed in and used for this purpose (U.S. Air Force, Luke AFB 2002b).

However, some occurrences of solid waste littering by recreational visitors, persons illegally entering the United States from Mexico, and other illegal dumping have been identified on the BMGR. Although no specific area has been identified as a central location for illegal dumping, solid waste has been spotted in areas along the borders of the BMGR as well as along Interstate 8 and State Route 85. Solid waste dumping has also been observed scattered in designated recreational use areas of the range. No established protocol is in place to handle wildcat dumping or littering on the range (Rothrock 2000, Moore 2000). The MCAS Yuma Environmental Department patrols BMGR—West using a series of prearranged patrol routes with established checkpoints to actively monitor areas that could potentially conceal an illegal dump site. When dump sites are located, actions are taken to remove the waste (Guillory 2002).

Solid waste is routinely collected under the authority of ADOT along State Route 85. The trash from the 15 receptacles located at highway pullout picnic areas is collected twice a week by a subcontractor, Handyman Maintenance Inc. This contract is managed out of the ADOT Gila Bend Maintenance Yard (Farnsworth 2002). In the past, trash pickup at the Baker Tanks Recreational Area was overseen by the BLM. Recently, however, the individuals using the area for recreation are now responsible for removing their own solid waste.

4.18.1.3 Military Munitions

Military munitions and the rules and regulations regarding the management of military munitions hazards and military munitions waste differ from other wastes. Over the years, Congress has specifically delegated statutory authority to the DoD for developing and promulgating explosives safety regulations for the safe storage, handling, and use of munitions. DoD has demonstrated a long and successful history in the management of these hazardous materials. In 1992, the Federal Facility Compliance Act was signed into law. This law required the EPA, in consultation with DoD and states, to publish regulations that identify when conventional and chemical military munitions become hazardous waste and subject to Subtitle C of RCRA. These regulations, titled the Military Munitions Rule (promulgated in Federal Register Volume 62, Number 29, Pages 6621-6657), define when military munitions become waste and how these waste military munitions will be managed. The Military Munitions Rule became effective on 12 August 1997.

In this ruling, the EPA determined that the ammunition and explosives storage standards and practices contained in DoD standards provide a degree of protection that meets or exceeds RCRA standards in virtually all respects. Thus, the military is conditionally exempt (when the State or EPA is petitioned and when certain other conditions are met) from RCRA Subtitle C storage regulation where waste military munitions are being properly stored or accumulated in compliance with DoD standards. Similarly, the military is also conditionally exempt from RCRA Subtitle C regulation when waste military munitions are transported in compliance with DoD shipping controls and Department of Transportation hazardous material transportation standards. Munitions that are being transported from one DoD facility to another DoD facility need not use the Uniform Hazardous Waste Manifest if the facility complies with the DoD transportation requirements.

As specified in the Military Munitions Rule, a military munition is not a solid waste when used for its intended purposes, which include (among others identified) use in training military personnel and in recovery, collection, and on-range destruction of unexploded ordnance and munitions fragments during range clearance activities. However, used or fired munitions are classified as solid waste when they are managed off range or recovered, collected, and subsequently buried or placed in a landfill on the range. In both cases, once the used or fired munition is a solid waste, it is potentially subject to regulation as a hazardous waste.

During routine military training missions at the range, military munitions are delivered from training aircraft to the air-to-ground ranges. Nearly all military munitions used on the BMGR have inert (non-exploding) warheads with the exception that they may carry a small (but still hazardous) spotting charge that produces a puff of smoke to reference the location of a hit. Some training using military munitions with live (exploding) warheads is necessary, but is tightly limited to five specific targets. According to the MLWA of 1999, the Air Force and Marine Corps must maintain a program of decontamination throughout the duration of the land

withdrawal. The BMGR military munitions range clearance program, which is further detailed in Section 4.18.3, controls surface build-up of ordnance on BMGR target ranges.

Ideally, hazardous constituents contained in these military munitions are consumed in a series of chemical reactions that occur upon detonation. Sometimes, however, military munitions fail to perform as intended and either do not fully detonate or do not detonate at all. During periodic range clearance activities, every effort is made by EOD teams to recover these munitions and detonate them in place. "Military munitions… are not a solid waste for regulatory purposes: (1) when a munition is used for its intended purpose, which includes when a munition is used for the training of military personnel and of explosives and emergency response specialists; when a munition is used for research, development, testing, and evaluation; and when a munition is destroyed during certain range clearance operations…" (Federal Register, Volume 62, Number 29, Preamble Section IV, G). Therefore, munitions that fail to detonate but that were used for their intended purposes are not considered waste. In addition, munitions detonated on the range by EOD personnel are part of military personnel training and are not regulated under RCRA because this use constitutes the normal use of the product rather than waste disposal.

While not considered a waste regulated by RCRA, if undetonated munitions are not recovered and the munitions case is damaged or eventually corrodes, it is possible that hazardous constituents could contaminate the environment. The eventual fate of the hazardous chemical constituents of malfunctioning military munitions that are not located during EOD clearances is undetermined. Also unknown is the extent to which chemical by-products produced by the firing and/or detonation of munitions are present on the range.

4.18.1.4 Formerly Contaminated Sites

During the late 1970s, the Air Force developed the Installation Restoration Program (IRP), a comprehensive program to evaluate historical activities involving the handling of hazardous materials. The IRP was developed to identify, investigate, and remediate past DoD waste releases at U.S. military installations worldwide. In 1984, Congress incorporated the IRP into the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA, also known as the Superfund Program) and Title III of the Superfund Amendments and Reauthorization Act.

In 1992, Luke AFB conducted a preliminary assessment at the BMGR as part of the IRP to evaluate the potential for environmental concern with regard to past handling procedures, disposal practices, and generation of hazardous materials at the range.

As a result of the preliminary assessment, the following 12 sites situated in seven locations on the BMGR were investigated and reviewed at the request of EPA in 1995 (U.S. Army Corps of Engineers 1995):

- two at the Gila Bend AFAF
- four at the Ajo Radar Station
- one at the munitions burial area at Range 1 (a location considered representative of all of the burial sites throughout the range)
- two at the U.S. Navy Sentinel Test Site
- one at AUX-2
- one at the Marine Corps EOD Operating Area
- one at the Fortuna Mine

EPA's review of the 12 sites was completed in 1997 at which time it was decided that no further action was warranted for 11 of the sites. The remaining site, an oil/water sump and outfall at the Ajo Radar Station on Childs Mountain in the Cabeza Prieta NWR, was directed to undergo remediation. This remediation was completed in December 1999 (Matthews 2001). Coincidentally, this area was not included as part of the BMGR reauthorized land in the MLWA of 1999.

EPA Region IX conducted a RCRA Facility Site Assessment during December 2001; results are pending. If new data become available regarding the extent and nature of hazardous substance contamination at the BMGR or should such contamination develop or be aggravated due to ongoing training operations in the future, the EPA may re-evaluate the need for additional cleanup and remediation under the IRP.

4.18.2 Interrelationship Between the Military Mission and Hazardous Materials and Wastes

With the reauthorization of the BMGR in the MLWA of 1999, Congress reconfirmed the nation's continued need for use of the range to sustain military training for aerial combat. Although the primary requirement of this act is to support the military mission and ensure no net loss in military training capabilities, all statutory requirements must also be met, including federal requirements (such as the Endangered Species Act, Clean Air Act, etc.), DoD policy and guidance, and state and local statutory requirements. As such, management and handling of hazardous materials and wastes must conform to these goals.

Typical hazardous products that will continue to be required include fuels and lubricants for vehicle transport and maintenance, paints and thinners for maintenance of targets and developed range administration and support facilities, and military ordnance. Because of the nature of activities on the BMGR, the use of hazardous materials will continue to be necessary as long as DoD continues to need the range. However, with the application of best management practices and pollution prevention policies, volumes and types of hazardous materials can be reduced. Accordingly, risks from the use of these materials can be minimized.

4.18.3 Existing Regulatory and Statutory Requirements and Management Plans and Actions

4.18.3.1 Management Responsibilities

All three RCRA programs—hazardous waste, solid waste, and USTs—have mechanisms by which states can exercise key program responsibilities. ADEQ has been authorized by EPA to implement the solid waste, hazardous waste, and UST programs in lieu of the federal programs. Arizona's regulatory provisions are at least as stringent as the federal provisions.

Per the MLWA of 1999 (P.L. 106-65 §3031(c)(3)(A)), the Marine Corps and Air Force, as the case may be, are responsible for and must conduct the necessary remediation of all releases or substantial threats of release, whether located on or emanating from the BMGR. The Act also states that the Air Force and Marine Corps are responsible for the use, management, storage, release, treatment, or disposal of hazardous materials, hazardous substances, hazardous wastes, pollutants, contaminants, petroleum products and their derivatives, military munitions, or other constituents. Contamination of the Cabeza Prieta NWR caused or contributed to by the Marine Corps or Air Force is the responsibility of the Marine Corps or Air Force, respectively, and not the responsibility of DOI. Local responsibility for the management of hazardous substances, materials, and wastes lies with the Environmental Flight at the 56th FW, Luke AFB for BMGR—East, and with the MCAS Yuma Environmental Department for BMGR—West. Within BMGR—West, Station Order 6280.3E, *Hazardous Waste Management Standard Operating Procedure*, provides direction for the management of hazardous waste and petroleum products.

The U.S. Border Patrol does not routinely generate hazardous materials or waste on the BMGR during surveillance and rescue activities. All refueling and vehicle maintenance activities are conducted off range. U.S. Border Patrol personnel routinely remove any solid waste generated during surveillance and rescue activities. Although no specific program is in place for removal of litter generated by UDAs, litter observed during UDA apprehensions is gathered and disposed of in approved facilities off the range. Typically the litter found is minimal, but occasionally an abandoned vehicle must be removed (Moore 2002b). If hazardous wastes were generated on the range, the Air Force would ultimately be responsible for any associated regulatory compliance issues on BMGR—East and the Marine Corps would be responsible for compliance issues on BMGR—West.

4.18.3.2 Military Munitions Decontamination Program

According to the MLWA of 1999 (P.L. 106-65 §3031(c)(1)), throughout the duration of the withdrawal of the BMGR the Secretaries of the Navy and Air Force shall carry out and maintain "...a program to address (i) any release or substantial threat of release attributable to military

munitions (including unexploded ordnance) and other constituents; and (ii) any release or substantial threat of release, regardless of its source, occurring on or emanating from such lands during the period of withdrawal and reservation and . . . provide to the Secretary of the Interior a copy of any report prepared by the Secretary of the Navy or the Secretary of the Air Force, as the case may be, pursuant to any Federal, State, or local environmental law, regulation, rule, or standard." The MLWA of 1999 (P.L. 106-65 §3032(f)(1)) also requires the Air Force and Marine Corps to maintain a program of decontamination, to the extent funds are available for such purpose, to maintain a level of cleanup for the portion of the Cabeza Prieta NWR used for military training purposes equivalent to the level of cleanup on 5 October 1999 (the date the MLWA of 1999 was enacted). In addition, the Act (§3031(b)(5)) requires the Air Force and Marine Corps, together with the Department of the Interior, to prepare a public report every five years from the publication date of the final INRMP. This report is to address the condition of the lands withdrawn, including a summary of current military use of the lands and any changes in military use since the previous report.

4.18.3.3 Cleanup of Active and Inactive Targets

An ongoing decontamination program has long been established at the BMGR to control surface build-up of ordnance on target ranges. The munitions on the surface of the manned and tactical ranges in BMGR—East are cleared by the 56th CES EOD Flight under direction of the 56th RMO. The Marine Corps Range Management EOD Department clears munitions from the Moving Sands and Cactus West target complexes in BMGR—West. A detailed description of the EOD clearance practices performed on the BMGR is provided in Appendix B.

Near-term EOD activity within BMGR—East involves an intensive ongoing search for inactive targets and planning for any required UXO or target debris clearances. Thus far, 38 inactive targets have been identified and surveyed for UXO contamination and target remnants. Eighteen of these inactive targets were found to contain munitions that should be removed after required cultural resource surveys and historical documentation of the sites and applicable NEPA and other environmental documentation (U.S. Air Force 2000b). Investigative efforts on military use areas that are discovered on the range continue to expand this body of work. The EOD and target clearance efforts planned for each inactive target will be scaled to meet the contamination characteristics of the site. UXO and target residue located at these sites will be processed as described in Appendix B. The 56th RMO will maintain an archive documenting each clearance site and the extent of EOD activity performed as a record that can be used to assess any future decontamination requirements at these inactive sites.

4.18.3.4 Spill Prevention and Response

The use of fuels and lubricants at the BMGR is necessary to sustain the use of surface vehicles and equipment. To prevent contamination from inadvertent spills of fluid, temporary

containment aprons made of high-density sheeting are placed beneath parked vehicles, supply drums, aboveground storage tanks and generators. On BMGR—West, the soiled sheeting material is removed from the BMGR and taken to the Cannon Air Defense Complex Satellite where it is stored until proper disposal by a licensed contractor in accordance with applicable hazardous waste disposal regulations (Guillory 2002). Surface vehicles are not refueled or maintained on BMGR—East (Rogers 2002).

Hazardous materials such as automotive and generator fuels, oils, lubricants, paints, cleaning solvents, pesticides, and herbicides are used at the Gila Bend AFAF, a developed range administration and support facility. To provide guidance in the event of a hazardous materials spill or an emergency involving hazardous materials, the Emergency Response Contingency Plan, Spill Prevention/Control and Countermeasure Plan (SPCC) was prepared by Spectrum Sciences & Software. The document also considers hazardous wastes generated at the base, including recycled oil and fuels, ethylene glycol (antifreeze), used batteries, and paint-related materials. According to established procedures, no hazardous waste accumulation sites are located at the Gila Bend AFAF but are instead stored at the point of generation. Various companies specializing in recycling and/or disposal of hazardous wastes transport and remove any drummed hazardous wastes from the site (Spectrum Sciences & Software, Inc. 2000). MCAS Station Order 6280.3E, *Hazardous Waste Management Standard Operating Procedures*, directs the use of hazardous substances at Cannon Air Defense Complex on BMGR—West.

Current management practices include requirements to notify the EPA and ADEQ of any hazardous substance spills that exceed established reportable quantities as required by CERCLA. The MLWA of 1999 also requires that DoD carry out and maintain a program to address any release or substantial threat of release attributable to military munitions (including unexploded ordnance) and other constituents; and any release or substantial threat of release, regardless of its source, occurring on or emanating from such lands during the period of withdrawal and reservation [P.L. 106-65 §3031 (c)(1)(B)].

4.18.3.5 Pollution Prevention

The goal of pollution prevention is to reduce or eliminate pollution at the source through conservation of resources, replacement of hazardous materials with other less hazardous or non-hazardous materials, waste reduction, and recycling. The DoD's program for pollution prevention includes the following three goals:

- comply with all legal requirements by promoting pollution prevention as the preferred means of achieving environmental compliance
- protect human health and the environment by reducing the use of hazardous materials as completely as possible
- reduce costs by integrating cost-effective pollution prevention practices into all DoD operations and activities, while ensuring performance of the mission

A number of pollution prevention programs are currently in force at Luke AFB, Gila Bend AFAF, and MCAS Yuma to reduce and/or prevent pollution. Although no specific programs are being applied on the BMGR beyond the specific confines of the military bases, the goals of the pollution prevention program are applied as appropriate. Specifically, the use of hazardous materials is minimized to the greatest extent possible and hazardous wastes produced as a result of military activities conducted on the range are contained and removed (Martinez 2001).

4.18.3.6 Aircraft Crash Response

The Air Force and Marine Corps maintain up-to-date crash response plans and response teams. These plans have been coordinated with the BLM, USFWS, and other agencies for responses to both on- and off-range mishaps. The basic plan components include (1) notification of the Luke AFB/MCAS Yuma command posts of the crash and location, if known; (2) activation of the response plan and dispatch of airborne search and rescue; (3) locate site/aircrew and complete rescue; (4) establish site security to protect public safety and preserve site/aircraft remains for post-accident investigation, (5) notify land managers/owners; (6) secure munitions, unspilled fuel, or other hazardous materials to the extent necessary and practicable; (7) consult with land managers/owners/regulatory agencies regarding surface access, removal of aircraft remains, and cleanup requirements and procedures; and (8) remediate and restore site per regulatory requirements and agreements with land managers/owners and regulators. Crash response plan procedures are updated as needed after each event.

4.18.4 Information Not Currently Available to Support Hazardous Materials and Wastes Management

Information obtained during the preparation of the affected environment section of this EIS indicates that wildcat dumping is becoming more prevalent, both along Interstate 8 and State Route 85, as well as along the southern border of the BMGR. Another waste problem within the range has been a growing accumulation of trash discarded by UDAs and broken-down vehicles abandoned by UDAs or smugglers. There is no source of information, however, that quantifies or tracks the occurrence or extent of illegal trash or waste dumping or vehicle abandonment within the BMGR. The lack of quantified data on the extent of illegal dumping, however, does not constitute incomplete or unavailable information, pursuant to 40 CFR §1502.22, that is needed to identify significant adverse impacts relevant to making a reasoned choice among alternatives for the proposed INRMP.

4.19 SOCIOECONOMIC RESOURCES

This section defines the existing economic and demographic conditions in the vicinity of the BMGR and provides the framework for the INRMP elements related to this resource. The following topics are discussed in this section:

- The resource setting on both national and local scales, current economic and demographic conditions, and future trends of communities that may be affected by range activities
- The interrelationship between socioeconomics and military use of the BMGR
- Current growth plans for affected communities
- Currently unavailable socioeconomic information that may affect future management of the BMGR

4.19.1 Existing Conditions

4.19.1.1 Introduction and Regional Perspective

On the range itself, habitation and economic development are not allowed for safety reasons. Thus, activities such as livestock grazing; mining; agricultural crop production; and residential, commercial, or industrial development have been excluded from the range. Public visitation is limited to recreational use where it is compatible with the safety and security requirements of the military mission. Although allowed, recreation activity has historically been of low, well-dispersed intensity in contrast to that experienced in nearby off-range locations.

In the vicinity of the BMGR, commercial and residential development has begun to emerge in recent years. According to the U. S. Census Bureau, the western United States steadily remains the fastest-growing region in the country, with a population increase of 1.5 percent between 1998 and 1999. From the 1990 to 2000 U.S. Census, Arizona was the third fastest growing state in the nation, increasing in population by 40 percent in 10 years, compared with the 13.2 percent increase nationally. This ranking went from third to second for the period of April 2000 to July 2001, when the total population estimate for Arizona was recorded at 5.3 million (U.S. Census Bureau 2001a).

This growth is not only felt in major metropolitan areas like Phoenix, Tucson, and Yuma, but also in outlying communities, including those in the immediate vicinity of the BMGR. The increased urbanization that has accompanied this population growth has increasingly put more reliance on public lands for outdoor recreation opportunities, including those available on the BMGR. Additionally, the North American Free Trade Agreement (NAFTA) of 1994, which promotes trade between Canada, the United States, and Mexico, has fueled an increase in economic activities in communities such as San Luis, located west of Yuma. NAFTA has produced substantial growth in the number of company relocations and expansions in the area.

Companies build plants on both sides of the border, which allows for the partial manufacture of products in Mexico and then transportation of products to the United States for finishing and distribution (City of Yuma 2001). Southern Arizona is geographically and economically well positioned to support continued demand from its export trading partners. Arizona Department of Commerce figures on export trade clearly show Mexico as a long-standing trading partner of Arizona. Mexico also purchases a great deal of other machinery, farm and factory equipment, and other items from Arizona. Ultimately, this and other demand is expected to support growth of roughly 26,500 jobs in the 2001-02 period for Arizona trade (Arizona Department of Economic Security 2002a).

4.19.1.2 General Demographics, Trends and Economic Conditions

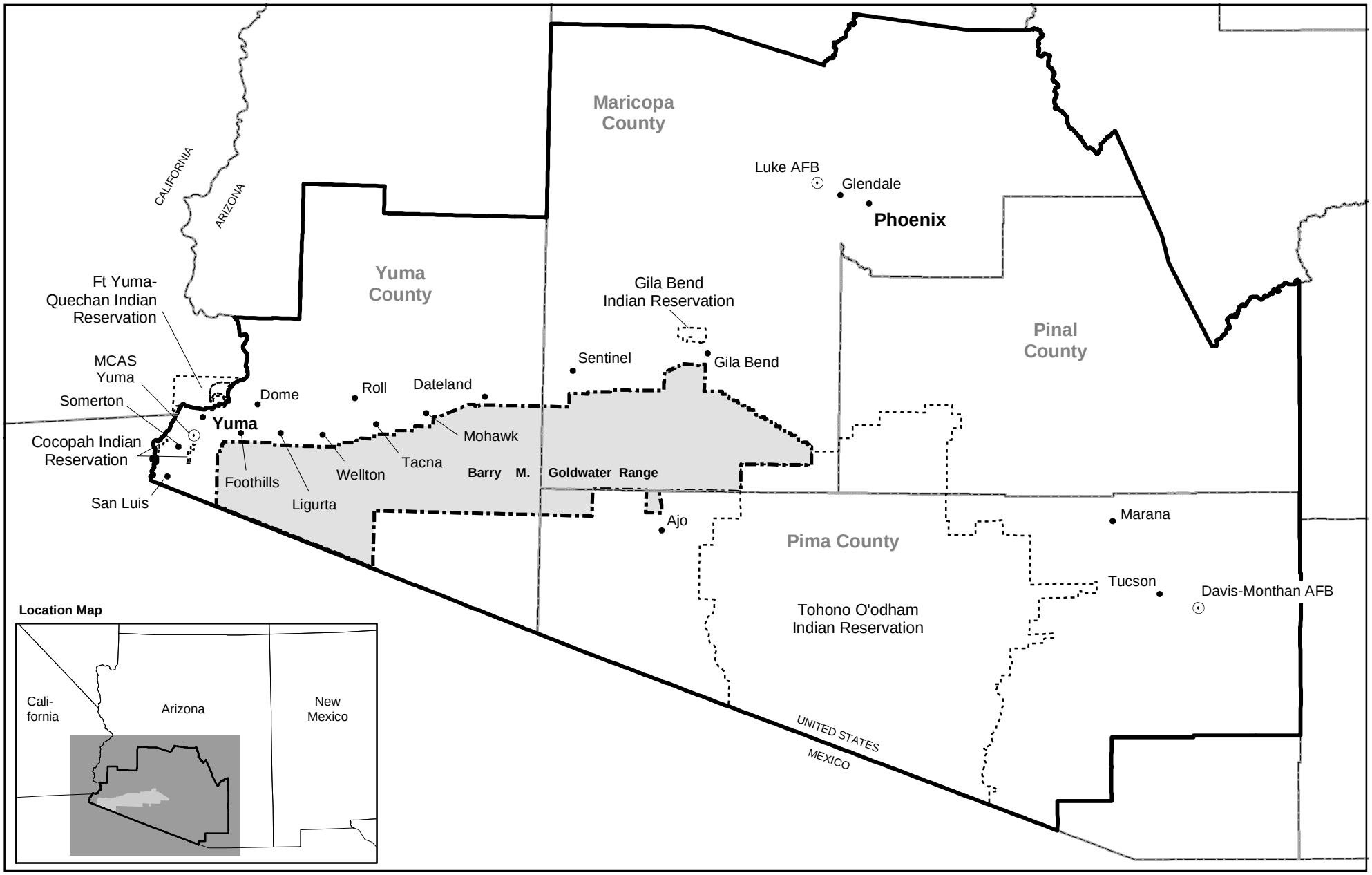
Study Area

The activities at the BMGR affect not only the communities that are in the immediate vicinity of the range, but also the communities of military installations that rely on the BMGR to support an important component of their training mission. For this analysis, cities with populations of 200,000 or greater in Maricopa and Pima County (Glendale, Phoenix, Tucson) were chosen for the study area as well as communities located within a 10-mile radius of the BMGR perimeter. Glendale and Phoenix are located in the vicinity of Luke AFB and Tucson is located near Davis-Monthan AFB. The study area also includes three Native American Reservations located within the vicinity of the BMGR: the Tohono O'odham Nation, Cocopah Indian Reservation, and Ft. Yuma-Quechan Indian Reservation. These communities are listed in Table 4-38. The locations of these communities and reservations are also shown in Figure 4-24.

TABLE 4-38
COMMUNITIES EVALUATED FOR SOCIOECONMIC EFFECTS ASSOCIATED WITH BMGR ACTIVITIES

County/Native American Reservation	City/Community	
Maricopa	Glendale Phoenix	Gila Bend* Sentinel*
Pima	Tucson Ajo*	
Yuma	Yuma* San Luis* Somerton* Wellton* Dateland* Foothills*	Dome* Ligurta* Roll* Tacna* Mohawk*
Native American Reservations	Ft. Yuma-Quechan Indian Reservation Cocopah Indian Reservation Tohono O'odham Nation (Main Reservation and Gila Bend Reservation)	

* Communities located within ten miles of the BMGR boundary



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20 10 0 20 40
Miles

Legend

- Military Installations
- Community
- Native American Reservation Boundary
- BMGR Land Boundary
- County Boundary
- Socioeconomic Study Area Boundary

BMGR Socioeconomic Study Area

Figure 4-24

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Data such as current population and population projections, unemployment rates, median household income, poverty status, and race were collected for the above counties, incorporated cities, unincorporated communities, and Native American Reservations within the study area. At the time of this report, the most comprehensive data available for the selected counties and communities in Arizona were from the 1990 census. Although 2000 census data had been collected and some data had been made available, information regarding several smaller communities was not yet available. Where U.S. Census Data were not available, 1999-2000 demographic data available from Arizona DES were used.

Many of the selected communities presented in this section are not incorporated within city limit boundaries. Thus, demographic data for these communities were gathered from census tract areas. According to representatives of the Cocopah Indian Tribe, the most recent demographic data for their tribe are 1990 census data (Soto 2000). The 1990 census data are also used for the other two Native American reservations within the study area.

The following demographic and economic conditions were identified:

Population Trends and Projections

Table 4-39 shows 1990 and 2000 population data for the study area as well as the five-year projections through 2025. Arizona's population in 2000 was 5,130,632. Three communities included within the study area had estimated populations above 100,000, while the rest of the communities were estimated to have a population below 20,000 (except Yuma, with a population of 77,515). During the 1990s, Arizona's population grew by roughly 32 percent (averaging annual growth of roughly 3.2 percent), representing a pace of growth that was about three-times the national average over the same period (Arizona DES 2001a). In general, population projections throughout the study area, as with the entire state of Arizona, predict a strong, continued increase through 2025. Compared to 1990, the state's population is projected to increase by 63 percent through the year 2025. Maricopa County is expected to increase in population by 60 percent, while Yuma County is expected to grow by 62 percent and Pima County by 67 percent.

TABLE 4-39
POPULATION PROJECTIONS THROUGH 2025

	1990 Population	2000 Population	2005	2010	2015	2020	2025
ARIZONA	3,665,228	5,130,632	5,553,849	6,145,108	6,744,754	7,363,604	7,993,039
Maricopa County	2,122,101	3,072,149	3,329,561	3,709,566	4,101,784	4,516,090	4,948,423
Gila Bend	1,747	1,980	1,955	2,387	2,542	2,695	3,049
Glendale	148,134	218,812	229,085	260,561	288,225	305,164	336,382
Phoenix	983,403	1,321,045	1,406,255	1,544,093	1,671,489	1,795,539	1,958,470
Maricopa County census tract 7233 including:							
Sentinel	5,150	8,328	n/a	n/a	n/a	n/a	n/a
Pima County	666,880	843,746	943,795	103,623	1,119,342	1,206,244	1,290,996
Ajo	2,919	3,705	4,075	4,304	4,533	4,756	4,969
Tucson	405,390	486,699	508,521	540,307	565,736	589,899	612,051
Yuma County	106,895	160,026	154,582	171,689	189,783	209,861	231,403
Somerton	5,282	7,266	7,475	8,224	9,001	9,872	10,818
San Luis	4,212	15,322	14,894	16,976	18,460	20,517	23,233
Wellton	1,066	1,829	1,326	1,415	1,507	1,610	1,722
Yuma	54,923	77,515	74,347	81,836	90,271	99,337	108,701
Yuma County census tract 106 including:							
Dateland	1,430	1,137	n/a	n/a	n/a	n/a	n/a
Yuma County census tract 111 including:							
Foothills	7,732	19,917	n/a	n/a	n/a	n/a	n/a
Yuma County census tract 112 including:							
Dome Ligurta Roll Tacna Mohawk	3,759	5,082	n/a	n/a	n/a	n/a	n/a
Native American Tribes							
Tohono O'odham Nation	8,422	10,787	n/a	n/a	n/a	n/a	n/a
Fort Yuma - Quechan Indian Tribe	3,155	n/a	n/a	n/a	n/a	n/a	n/a
Cocopah Indian Tribe	1,718	1,025	n/a	n/a	n/a	n/a	n/a

n/a=not available
Sources: Arizona DES 2001b, 2001c, 2002b.
U.S. Census Bureau 1990 *in* Geraghty & Miller, Inc. 1996 (for Native American Tribe data)

Employment

Both 1990 and 2000 employment data are depicted in Table 4-40. This table presents total labor force, total persons unemployed, and the average unemployment rate (expressed as a percentage) for the study area. In 2000, Arizona had an unemployment rate of 3.9 percent. This shows a decrease in the state unemployment rate from 5.3 percent in 1990. Of the three counties within the study area, Maricopa County has the lowest year 2000 unemployment rate at 2.6 percent, while Yuma County has the highest at 27.5 percent. In 2000, the community with the lowest

unemployment rate is Glendale at 2.6 percent, which is one full percentage point below the state average. The individual community with the highest unemployment rate is Wellton, located within Yuma County, at 26.9 percent.

TABLE 4-40
UNEMPLOYMENT RATE FOR AFFECTED AREAS

	1990			2000		
	Labor Force	Unemployed	**Unemploy-ment Rate (Percent)**	**Labor Force**	Unemployed	**Unemploy-ment Rate (Percent)**
ARIZONA	**1,798,000**	**96,000**	**5.3**	**2,346,997**	**91,223**	**3.9**
Maricopa County	**1,070,667**	**64,742**	**6.0**	**1,503,466**	**39,573**	**2.6**
Gila Bend	739	80	10.8	1,008	49	4.9
Glendale	78,370	4,760	6.1	110,031	2,909	2.6
Phoenix	515,284	34,339	6.7	720,894	20,990	2.9
Maricopa County census tract 7233 including:						
Sentinel	2,225	213	9.6	n/a	n/a	n/a
Pima County	**313,831**	**23,773**	**7.6**	**383,866**	**10,933**	**2.8**
Ajo	756	82	10.8	905	38	4.2
Tucson	196,051	16,349	8.3	238,565	7,519	3.2
Yuma County	**41,951**	**4,762**	**11.4**	**65,703**	**18,092**	**27.5**
Wellton	382	42	11.0	595	160	26.9
Yuma County census tract 106 including:						
Dateland	940	40	4.3	n/a	n/a	n/a
Yuma County census tract 111 including:						
Foothills	2,365	190	8.0	n/a	n/a	n/a
Yuma County census tract 112 including:						
Dome Ligurta Roll Tacna Mohawk	1,456	97	6.7	n/a	n/a	n/a
Native American Tribes						
Tohono O'odham Nation	551	310	56.3	n/a	n/a	n/a
Fort Yuma - Quechan Indian Tribe	937	150	16.0	n/a	n/a	n/a
Cocopah Indian Tribe	617	69	11.2	n/a	n/a	n/a

n/a = not available
Sources: Arizona DES 2002c
U.S. Census Bureau 1990.

Income Characteristics

As shown in Table 4-41, the 2000 median household income in Arizona was $40,558, which is $13,018 higher than in 1990. The 2000 median household income for Maricopa County was

slightly higher than the state figure, but Pima County and Yuma County were slightly lower. Of the communities evaluated, Glendale had the highest 2000 median household income and San Luis, Arizona had the lowest. Although most of the study area communities had a smaller portion of people living below poverty in 2000 than in 1990 (the poverty rate for both the Tohono O'odham Nation and the Cocopah Indian tribe both decreased by over 20 percent), the communities of San Luis, Dateland, Foothills, Dome, Ligurta, Roll, Tacna, and Mohawk all had a greater percentage of people living below the poverty line in 2000 although the median household income increased over the decade.

Poverty Status

Poverty statistics for the study area are also shown in Table 4-41. In 2000,9.9 percent of Arizona's population was living below poverty (the poverty level for a family of four in 2000 having two children under the age of 18 was $17,463). Compared to the state poverty statistics, Maricopa County had a lower percentage and Pima and Yuma counties had a higher percentage of people living below poverty. San Luis had the highest percentage of people living below poverty and Glendale had the lowest percentage.

TABLE 4-41
1990 and 2000 MEDIAN HOUSEHOLD INCOME AND POVERTY STATUS FOR AFFECTED AREAS

	1990 Median House-hold Income	2000 Median House-hold Income	1990 Percent Below Poverty	2000 Percent Below Poverty
ARIZONA	$27,540	$40,558	15.7	9.9
Maricopa County	$30,797	$45,358	12.3	8.0
Gila Bend	$17,820	$26,895	31.3	22.2
Glendale	$31,665	$45,015	11.5	8.8
Phoenix	$29,291	$41,207	14.2	11.5
Maricopa County census tract 7233* including:				
Sentinel	$23,202	$69,583	24.3	1.2
		$33,576		19.4
Pima County	$25,401	$36,758	17.2	10.5
Ajo	$16,302	$25,618	23.3	16.5
Tucson	$21,748	$30,981	20.2	13.7

TABLE 4-41
1990 and 2000 MEDIAN HOUSEHOLD INCOME AND POVERTY STATUS FOR AFFECTED AREAS

	1990 Median House-hold Income	2000 Median House-hold Income	1990 Percent Below Poverty	2000 Percent Below Poverty
Yuma County	$23,635	$32,182	19.9	15.5
Wellton	$16,574	$27,045	22.0	16.1
Yuma	$26,753	$35,374	16.0	12.1
Somerton	$15,094	$26,544	43.6	24.0
San Luis	$15,554	$22,966	35.5	36.3
Yuma County census tract 106 including:				
Dateland	$17,333	$24,514	30.6	34.3
Yuma County census tract 111* including:				
Foothills	$20,691	$41,088	7.6	8.9
		$32,525		10.9
		$32,785		9.3
Yuma County census tract 112 including:				
Dome Ligurta Roll Tacna Mohawk	$20,941	$30,043	15.8	18.4
Native American Median Household Income				
Tohono O'odham Nation	$9,527	$30,043	64.5	40.5
Fort Yuma-Quechan Indian Tribe	$11,466	$19,970	36.2	34.1
Cocopah Indian Tribe	$15,710	$26,400	41.8	20.7

Source: U.S. Census Bureau 2000 and 1990.
*Maricopa County Census Tract 7233 and Yuma County Census Tract 111 were not divided into two and 3 block groups, respectively, for the 1990 census, but were in 2000.

Race and Hispanic Origin Ethnicity

Table 4-42 shows the breakdown of population according to race and ethnicity for the selected counties and communities within the study area in 1990. Hispanic origin statistics represent all persons who identify themselves as Mexican, Puerto Rican, Cuban, Central American, or of other Hispanic origin or descent. These data reflect ethnicity, not race. The Hispanic-origin ethnic group exceeds 50 percent of the population in San Luis, Somerton, and Dateland. The Foothills community, located within census tract 111, displayed the highest percentage of White population at 94 percent, and San Luis had the lowest percentage of White population at less than one percent.

TABLE 4-42
RACE AND HISPANIC ORIGIN FOR AFFECTED AREAS

Affected Area		Population (2000)					
		White	Black	Hispanic Origin	Native American	Asian and Pacific Islander	Other, not Hispanic
ARIZONA		3,272,065	146,183	1,295,317	233,352	94,252	6,175
Maricopa County		2,033,420	106,204	763,333	45,466	68,101	4,076
Gila Bend		627	13	1,059	163	0	0
Glendale		141,000	10,036	54,324	2,020	5,867	205
Phoenix		737,369	61,835	450,423	21,966	26,320	1,462
Maricopa County census tract 7233* including:							
Sentinel	7233.01	7,355	142	331	36	27	0
	7233.02	2,607	53	2,112	494	24	0
Pima County		517,982	23,047	247,861	22,640	17,343	1,022
Ajo		1,990	10	1,415	219	25	1,415
Tucson		263,269	19,426	174,354	8,012	11,902	174,354
Yuma County		71,130	2,932	80,828	1,948	1,409	80,828
San Luis		1,114	424	13,621	110	7	13,621
Somerton		286	30	6,929	0	10	6,929
Wellton		1,065	38	796	16	6	796
Yuma		37,231	2,091	35,088	962	1,076	35,088
Yuma County census tract 106 including:							
Dateland		283	0	857	0	3	0
Yuma County census tract 111* including:							
Foothills	111.01	4,251	96	1,118	25	0	0
	111.02	5,553	12	1,070	50	0	0
	111.03	6,753	19	596	43	23	0
Yuma County census tract 112 including:							
Dome Ligurta Roll Tacna Mohawk		2,908	45	1,998	33	55	0
Native American Tribes							
Tohono O'odham Nation		315	6	759	9,150	36	20
Fort Yuma-Quechan Indian Tribe		353	1,200	645	1,200	28	645
Cocopah Indian Tribe		447	6	69	505	4	69

Source: U.S. Census Bureau 2000.
*Maricopa County Census Tract 7233 and Yuma County Census Tract 111 were not divided into two and 3 block groups, respectively, for the 1990 census, but were in 2000.

4.19.1.3 Economic Profiles

Arizona's economy is based primarily on services, trade, and manufacturing. In the service industry, wholesale and retail trade provide a large number of jobs, especially with tourism, an industry that provides billions of dollars to the state's economy every year. State tourism

industry that provides billions of dollars to the state's economy every year. State tourism generates more than 115,000 jobs and indirectly supports an additional 185,000 jobs (Arizona Department of Commerce 2001b). The Cabeza Prieta and Kofa NWRs, and Organ Pipe Cactus NM are examples of natural tourist attractions located near the BMGR.

Agriculture and mining are also important, especially in southwestern Arizona. Primary agricultural crops include cotton, citrus, hay, lettuce, cauliflower, broccoli, and melons. Mining provides 10,000 people with employment and produces a mineral output of more than $4.9 billion (Arizona Department of Commerce 2001c). The mining industry, however, has experienced a decrease in activity in recent years due to a market reduction in copper prices.

Community economic profiles, by county, are provided below.

Maricopa County

Maricopa County includes some of the fastest growing communities in the country, such as Chandler, Gilbert, Glendale, Mesa, Peoria, Scottsdale, Sun City, and Tempe. Total nonfarm employment in Maricopa County averaged 6.1 percent yearly growth from 1995-1998. The largest growth occurred in the finance, insurance, and real estate industry (represented as a single industry), which experienced an overall average yearly growth of 10.1 percent. The construction and services industries also experienced gains at 7.7 percent and 7.2 percent, respectively (Arizona Department of Commerce 2001b).

Phoenix, the capital of Arizona, is the sixth largest city in the nation and the location of the Maricopa County seat. Founded in the mid-1800s, Phoenix experienced an explosion of growth during World War II when military airfields, including Luke AFB, were built in Maricopa County due to the desirable flying weather. Today, manufacturing, electronics, and tourism make up the majority of the economic base in Phoenix. Motorola, AlliedSignal, and American Express employ thousands of Phoenix workers. The retail and trade sectors employ over 45 percent of Phoenix workers (Arizona Department of Commerce 2001b).

Glendale, Arizona's fourth largest city, is a commercial and industrial community in the northwest portion of the Phoenix metropolitan area. Luke AFB was annexed by Glendale in August 1995 and is Glendale's largest public sector employer, providing more than 7,000 jobs. In addition, the manufacturing, service, aerospace, communications, precision metal working and casting, chemicals, electronics, and warehousing industries comprise the economic base of Glendale (Arizona Department of Commerce 2001b).

Gila Bend is located just north of the BMGR at the intersection of Interstate 8 and State Route 85. Gila Bend's principal economic activity, and the mainstay of its economy, is agriculture. Cotton is the primary production crop as well as alfalfa and grain. The Gila Bend AFAF, located

on the BMGR and within five miles of Gila Bend, employs 125 contract workers. Gila Bend's location also bodes well for providing services to tourists because Interstate 8 is a major route between San Diego and Phoenix and Tucson, and State Route 85 is a major route between Phoenix and Rocky Point, Mexico, a growing resort community.

Although agriculture drives the economy in Gila Bend, there is an emerging trend toward the development of residential and commercial communities within the area (Arizona Department of Commerce 2001b) (see Section 4.15 Transboundary and Domestic Perimeter Land Use for more information).

Pima County

During the 1990s, Pima County's population grew by about 27 percent, or roughly 2.7 percent annually. (Arizona increased its population by 32 percent during the 1990s.) Pima County covers 9,184 square-miles of land and has a population of approximately 866,000. Major industries within Pima County include aerospace, bioindustry, manufacturing, and optics.

Tucson is the second-largest city in Arizona and is also the Pima County seat. Federal, state, and local government employ more that 60,000 people. The University of Arizona is the largest non-government employer with more that 10,000 employees. Davis-Monthan AFB employs over 8,000 military and civilian employees. The Arizona ANG also contributes to Tucson's economy. Additionally, tourism is a major component of Tucson and Pima County's economic base (Arizona Department of Commerce 2001b).

Ajo was founded in the early-1900s as a copper mining town and is now considered a popular retirement community. In 1906, Phelps Dodge purchased a mine in Ajo where, for several decades, more than 1,000 people were employed. In 1986, Phelps Dodge closed the mine and sold hundreds of their homes to retirees. Since then, Ajo's economic base has consisted of tourism, service, and other commercial businesses. Due to its location near Mexico and Organ Pipe Cactus NM, it is a popular tourist stop for travelers. Phelps Dodge plans to re-establish mining operations in the future, and estimates that approximately 400 people will be employed through the operation (Arizona Department of Commerce 2001b).

Yuma County

During the 1990s, Yuma County's population grew by 26 percent, or roughly 2.8 percent annually. Yuma County is the state's leading agriculture-producing county. Crop, fruit and vegetable production in Yuma County result in an industry valued at approximately $1 billion. Yuma is the largest city in the county, with San Luis being the second largest. While agriculture-related occupations are the major sources of employment in Yuma County, the nonfarm sector

has experienced an increase of 3.2 percent annually from 1995-1998. During the same time period, the construction industry experienced a yearly growth of 11.4 percent (Arizona Department of Commerce 2001b).

Yuma, the county seat of Yuma County, is located just south of where the Gila and Colorado rivers converge. The military installations affecting Yuma County's economy include MCAS Yuma and the Yuma Proving Ground. Tourism also contributes greatly to Yuma's economy, due to its major influx of annual winter visitors. Winter visitors typically originate from Washington state, Oregon, Montana, the Midwest and Canada. These travelers concentrate in the Yuma Foothills area, located east of Yuma along Interstate 8. Yuma's population increases from approximately 70,000 people to approximately 200,000 during the winter season (Gallagher 2001).

Other communities located east of Yuma, along Interstate 8 include **Ligurta, Dome, Roll, Wellton, Tacna, Dateland, Mohawk, and Sentinel**. (Sentinel is located just inside the boundaries of Maricopa County.) Recent economic growth in this area has fueled the construction of several residential subdivisions located on both the west and east sides of the Gila Mountains (near Ligurta and Wellton) (Gallagher 2001).

San Luis, located twenty-three miles southwest of Yuma, has experienced substantial growth of manufacturing facilities since the mid-1990s due to NAFTA. In 1994, commercial traffic crossing the United States/Mexico border at San Luis increased 13 percent, while the number of Mexican visitors crossing there increased to 15 million. Additional international transportation is expected to increase with the construction of a new area service highway (see Section 4.16, Transboundary and Domestic Perimeter Land Use, for more information) (City of Yuma 2001).

Economists agree that Arizona's economy will continue to grow in the future, without any serious imbalances. Economic growth is rapid enough to support healthy population growth, and although the rate forecast is significantly slower for the start of the 21st century, it is still fairly rapid (Arizona Department of Commerce 2001e).

Native American Reservations

The **Tohono O'odham Indian Nation** land base is comprised of four different land areas—the Main Reservation, San Xavier Reservation (outside of the study area near Tucson,), Florence Reservation (outside of the study area near the City of Florence), and the San Lucy District near Gila Bend. The main reservation consists of 2,773,357 acres of land primarily within Pima County. The Gila Bend Reservation is the 497-acre San Lucy District of the Tohono O'odham Nation, located north of the City of Gila Bend (Siow 2003). Federal, state, and tribal agencies are the largest employers on the Tohono O'odham Indian Reservation. Cattle raising is also a primary part of the employment sector and the economy is expected to grow in the agricultural,

retail-tourism, gaming, and utilities sectors in the future (Arizona Department of Commerce 2001b).

The Cocopah Indian Reservation is located approximately 13 miles south of Yuma. Totaling almost 8,000 acres, the reservation (which includes an east, west, and north reservation) includes about 2,400 acres of irrigated agricultural land. All of this land is farmed through land leases to non-Indians. Income from agriculture totals approximately $250,000 per year. In 1987, several commercial businesses including a bingo hall, convenience store, smoke shop, and gas station were opened on the reservation. The bingo hall and casino employ 50 tribal members (Arizona Department of Commerce 2001b).

The Ft. Yuma-Quechan Indian Tribe is located along both sides of the Colorado River near Yuma, Arizona. The reservation borders Arizona, California, Baja California and Mexico. Encompassing 45,000 acres, the reservation is bisected on the south by Interstate 8. Consequently, several million cars drive through the Fort Yuma-Quechan Reservation each year.

Largely an agriculture community, the Tribe collects income from a 700-acre leased farm and a long-term sand and gravel lease to a corporation that employs 8 to 10 tribal members. In addition to farming and the sand and gravel operation, the Fort Yuma Quechan Reservation relies on tourism and related business to augment its economy. The Tribe manages five trailer and RV parks, a small grocery store, museum, bingo hall, utility company, and a fish and game department (Ft. Yuma Quechan Indian Tribe 2001).

4.19.2 Interrelationship Between the Military Mission and Socioeconomics

This section describes how study area socioeconomics are interrelated with natural and cultural resources management of the range. While community socioeconomics within the study area are not potentially affected by the proposed INRMP to the degree that they would be if the proposal under consideration involved a military base closure or realignment, range management policies can have some socioeconomic effects. Another interrelationship is that as population and urban development increase in the study area communities, challenges to the future military mission also have the potential to occur. Issues of importance and social attitudes and values of those issues were identified during the public scoping process for the proposed BMGR INRMP and have been considered throughout the INRMP planning process (see Section 1.8 for more information).

4.19.2.1 Installation Contribution to Employment

Luke AFB is Glendale's largest public sector employer, providing more than 7,000 jobs. The Air Force employs approximately 125 contract workers in Gila Bend, and Davis-Monthan AFB

employs over 8,000 military and civilian employees in the Tucson area (Arizona ANG also contributes to the Tucson economy). MCAS Yuma employs approximately 6,200 military and civilian employees and the Yuma Proving Ground employs about 1,650, with these installations primarily contributing to Yuma's local economy. Although not analyzed as part of the study area for this project, the economy of other communities, particularly in southern California, are affected by military operations of the BMGR because other installations (such as MCAS Miramar near San Diego) also train at the range.

The most recent analysis describing the degree of effect of (1) the BMGR on the installations that use it and (2) the installations on various affected areas (states, counties, Native American Reservations and communities) was included in the BMGR LEIS (U.S. Air Force 1999). In order to accurately describe the affected environment, socioeconomic models were used to analyze published data from the installations and the U.S. Census Bureau.

Through published data and interviews, it was determined that gross payrolls at the military installations utilizing the BMGR total $590 million. The results of the socioeconomic models, however, showed only the BMGR component of effects related to the military installations. As a result, it was determined that the entire study area experiences 17,171 direct jobs, 49,231 indirect jobs, and estimated wages totaling $1.8 billion from activities at the BMGR. Tax revenues for the study area were also determined in the BMGR LEIS using a submodel. Table 4-43, outlining employment and tax data from the BMGR LEIS study is provided below.

TABLE 4-43
AGGREGATION OF SOCIOECONOMIC MODELING RESULTS FOR AREAS AFFECTED BY THE BMGR LAND WITHDRAWAL

	States	Counties	Communities
Number of worker households in communities, adjusted for workers per household		25,073	22,164
Employed in Communities			
Employment		37,749	28,575
Earnings		$998,549,684	$763,920,612
Taxes			
Sales Taxes		$4,773,447	$5,919,479
Property Taxes		$6,144,920	$10,180,773
Revenue Sharing			$3,428,438
Total Tax Revenues		$10,918,367	$19,528,689
Retail taxes to state (total, includes shared amounts)	$29,633,775		
Income taxes to state (total, includes shared amounts)	$18,481,252		

Note: Shading indicates no modeling results exist in that category.
Source: Geraghty & Miller, Inc. 1996

Under the provisions of the MLWA of 1999, the DoD assumed full natural and cultural resources management responsibility on the BMGR from the BLM on 6 November 2001. As a result, allocation of monetary funds for future resources management also shifted. Operating budgets for both the Marine Corps and the Air Force have or are expected to increase to reflect the need for additional personnel. This economic shift is evident in the increase in BMGR security personnel that occurred after 6 November 2001. Whereas prior to the transfer of responsibility to the DoD, there were one to two law enforcement positions, seven full-time BMGR security and/or law enforcement personnel are currently employed (five with the Air Force for BMGR—East and two with the Marine Corps for BMGR—West).

4.19.2.2 Socioeconomic Impacts of Military Withdrawal

As previously mentioned, the MLWA of 1999 specifically excludes grazing, mining, mineral, and geothermal development, and other such incompatible land uses on the range for the term of the withdrawal. However, these activities have not occurred on the range since 1941. In effect, this policy limits the geographical extent of economic development that fuels the local economies of the communities surrounding the BMGR. Because of the military withdrawal, the economic potential for BMGR lands to support these activities cannot be realized until the withdrawal expires or is no longer in effect.

The military withdrawal of the BMGR also has impacts in terms of resource management planning. Integrated natural resources management planning by the Secretaries of the Air Force and Navy is different from that of other federal agencies that manage public lands. Because other public lands are typically not subject to the same preclusions on development that are prescribed by law on the BMGR, they are often used in support of human activities such as mining, oil and gas production, timber, and livestock grazing. During the planning process, these agencies assess the socioeconomic values and attitudes for such economic-based uses of public lands and balances these uses against other uses such as outdoor recreation and resource management and preservation. On the BMGR, however, the primary human and economic activity consists of military exercises that support national defense. The Sikes Act, which guides natural resources management on military installations, does not address economic implications of military use or withdrawal. Further discussion of how the Sikes Act addresses social and economic factors and how they will be addressed in this EIS is provided in the following subsection.

4.19.3 Existing Regulatory and Statutory Requirements and Management Plans and Actions

Unlike other resources, such as biological and water resources, there are not often plans, programs and regulatory or statutory requirements that pertain specifically to socioeconomics.

Rather, considerations for social and economic factors are typically an integral part of the land management process. This is particularly true for the BMGR because the prohibition of human habitation and appropriative land uses, such as mining or grazing, precludes the influence of many social or economic factors that would be thought to directly influence most land management processes (such as forestry use on lands managed by the Forest Service). This goes hand-in-hand with the NEPA requirement to discuss effects on the human environment when economic or social and natural or physical environmental effects are interrelated (40 CEQ 1508.14). Because there are recreational opportunities on the BMGR and because much of the range is in a relatively undisturbed condition, there are strong social values and interests regarding the BMGR. Much of the land in the region is under federal jurisdiction, and large adjacent land areas such as the Cabeza Prieta NWR and Organ Pipe Cactus NM are managed primarily for resource protection and preservation. Therefore, the social values tend to be on a regional scale rather than specific to the BMGR.

With the 1990 Goldwater Amendment, the land use planning process was based on FLPMA and BLM planning guidelines, which require that public attitudes and values for resources management and resource use be considered in the development of land use and management plans. In a somewhat similar fashion, the conservation program outlined in the Sikes Act and DoD instruction for implementing the Sikes Act (DoD Instruction 4715.3, Environmental Conservation) calls for the sustainable multipurpose use of the resources and public access to military installations to facilitate the use. The ecosystem management principles of DoD Instruction 4715.3 consider people and their social and economic needs as a part of a complex system functioning as a whole, not as a collection of parts. The NEPA requirements pertain equally to the land use planning under FLPMA and the Sikes Act.

Similar land use planning efforts have been undertaken for the areas surrounding the BMGR (e.g., Cabeza Prieta NWR) and/or for areas including the BMGR (e.g., county plans). Because these populations and their population demographics have influenced the amount of interest in the recreational opportunities at the BMGR and as Arizona has experienced substantive population growth, the BMGR has also experienced trends of increased visitor use. Therefore, a brief overview of regional plans, changing population demographics, and the economic influences on the communities near the range and the communities near the installations that rely on the BMGR for recreation are included herein for informational purposes. More information about these plans is provided in Section 4.15, Transboundary and Domestic Perimeter Land Use.

4.19.3.1 Existing Management Plans

Maricopa Association of Governments

MAG provides regional planning and policy decisions in areas of transportation, air quality, environmental analysis, regional development, and social services. When MAG was formed in

1967, the elected officials recognized the need for long-range planning and policy development on a regional scale. Many issues such as transportation and air quality affected residents beyond the borders of their individual jurisdictions.

MAG is the designated Metropolitan Planning Organization (MPO) for transportation planning in the Maricopa County region. MAG has also been designated by the Governor's Office to serve as the principal planning agency for the region in a number of areas including air quality, water quality, and solid waste management. In addition, through an Executive Order from the Governor, MAG develops population estimates and projections for the region. On 1 July 1988, Arizona Governor Rose Mofford signed Executive Order 88-10, which provided for the preparation of population estimates and projections for the State of Arizona. In this Executive Order, regional councils are provided a role in developing population estimates and projections. On 10 February 1995, a revised Executive Order 95-2 was issued by the Governor, indicating that only one official set of population projections would be developed every five years.

Each year, MAG recommends to the Arizona DES the population updates for 1 July of the current year. These updates are utilized by the State for planning purposes and also for the distribution of the lottery funds to local government. In addition to providing population updates to DES, MAG also produces long-range population projections for this region every five years. These projections are used by State agencies for planning purposes. They are also used by MAG for regional planning and serve as the foundation for the transportation planning process (MAG 2002).

Pima County Association of Governments

In December 1973, the Governor of Arizona designated PAG as the MPO for the Tucson metropolitan area. PAG is a non-profit corporation governed by a Regional Council comprised of elected officials from six local jurisdictions and a member of the State Transportation Board. PAG coordinates regional planning issues that cross jurisdictional boundaries such as air quality, water quality, transportation, land use, and human services.

PAG is the MPO for the greater Tucson area. As an MPO, PAG is responsible for coordinating the urban transportation planning process and receives federal transportation funding for distribution to its member jurisdictions. PAG member jurisdictions include: the City of Tucson, the City of South Tucson, Pima County, and the towns of Marana, Oro Valley, and Sahuarita. PAG’s planning programs are developed through a cooperative, interagency process involving technical, professional, and management staff from each PAG member jurisdiction; citizens and citizen interest groups; elected officials; and other federal, state and local agencies and jurisdictions. Because PAG is not a governmental agency, the responsibility for implementing PAG plans lies with its member jurisdictions.

Each year, PAG, through the cooperative efforts of its member jurisdictions, the State of Arizona, and interested agencies, prepares population estimates and projections for Pima County and its incorporated jurisdictions. Population estimates are based upon real data for a date that has passed, whereas population projections are based upon educated guesses about future conditions. Both estimates and projections take into account current economic, demographic, and land use trends.

City of Yuma Joint Land Use Plan

The City and County of Yuma have prepared a Joint Land Use Plan as amendments to their respective General Plans covering land areas of mutual interest to achieve the following:

- a common "blue print" of land uses and land use development policies for the future economic growth and development of lands within the incorporated and unincorporated areas around the City of Yuma.
- a foundation for the compatibility of land use activities in the vicinity of the MCAS Yuma/Yuma International Airport. The primary economic assets of the area (agriculture, the air station, and tourism) are protected, reinforced, and supplemented by the expansion of industrial sector opportunities that will provide more year-round employment prospects.

One of the planning strategies in developing the plan includes the protection and reinforcement of community assets to (1) provide land uses, policies, and implementation measures which support and balance its economic assets (i.e., agriculture, government, tourism) and (2) to encourage the growth and significance of the industrial components of the economy, providing stable, year-round employment (City of Yuma and Yuma County 1996).

Maricopa County Comprehensive Plan

The Economic Development Element of the Maricopa County Comprehensive Plan, *Maricopa 2020, Eye to the Future*, states:

> Maricopa County has the power to intervene as a catalyst or facilitator for quality development in the region. Thoughtful land use decisions, comprehensive transportation planning, and sensitive environmental controls, combined with economic development opportunities, should aid in the generation of quality jobs and contribute to the enhancement of the quality of life for residents and communities.

Gila Bend Master Plan Update

The Gila Bend Master Plan Update, adopted by the Gila Bend Town Council on 27 August 1996, consists of three plan elements, which are intended to guide growth in Gila Bend. The plan elements include: Land Use, Circulation, and Public Facilities and Services. The Land Use Element also contains economic development strategies for the town. The Land Use Element designates the general location and intensity of land uses for residential, commercial, industrial, parks, open space and public facilities in the town. The economic development component of the Land Use Element recommends strategies to enhance the economy of the town, retain and expand existing businesses and identifies specific industries that may be targeted by the town in its economic development efforts (Town of Gila Bend 1996).

4.19.3.2 Applicable Guidance

Department of Defense Instruction 4715.3, *Environmental Conservation*

As part of the socioeconomic analysis for this EIS, it is important to identify the social attitudes and values when considering the effects of the various management alternatives. For the DoD, the best guidance for social and ecosystem management principles lies with DoD Instruction 4715.3, *Environmental Conservation*. This guidance states that "Ecosystem management is a process that considers the environment as a complex system functioning as a whole, not as a collection of parts, and recognizes that people and their social and economic needs are a part of the whole."

4.19.4 Information Not Currently Available to Support Socioeconomic Resources Management

The current lack of some data or information pertaining to the socioeconomic implications of managing the natural and cultural resources of the BMGR were identified during the preparation of the affected environment section of this EIS. It does not constitute incomplete or unavailable information needed to conduct the environmental impact analysis presented in Chapter 5 in accordance with 40 CFR §1502.22. Although additional requirements for socioeconomic information may be defined in the future, those identified in this document include:

- *Demographic Data.* The most comprehensive demographic data available for preparing this EIS were 1990 U.S. Census data. Although Census 2000 data had been collected, complete data were not available yet. Some updated demographic data were available from Arizona DES and Arizona Department of Commerce; however, a more accurate representation of Arizona's socioeconomic conditions would be depicted with complete 2000 data. Arizona Department of Commerce predicts the recent economic and

population growth will continue in the western United States, Arizona, and local communities affected by activities at the BMGR. This population growth near the BMGR perimeter has the potential to affect BMGR natural resources management. There is no current source of information, however, that directly quantifies or tracks growth patterns that may specifically affect the BMGR.

- *Economic Effects.* There are no existing data that quantify the specific economic impacts of expenditures related to ongoing or proposed natural and cultural resource management, scientific research, or recreation activities for or within the range.

4.20 NOISE

4.20.1 Existing Conditions

The BMGR occupies a remote, principally undeveloped, and uninhabited wildland environment. In the absence of military or non-military human activities, the background noise that occurs within those portions of the range that are away from developed areas on its perimeter is typically characterized by sounds produced by weather, wildlife, and other natural phenomenon. Natural quiet within the range under these conditions can reach levels of stillness comparable to other remote desert wilderness areas.

Human caused noise is generated within the BMGR and its immediate vicinity by a variety of military and non-military activities. Given the remoteness of the range from development and its status as a military installation reserved principally for military aviation training activities, those activities are not surprisingly the predominant sources of noise within the range. Some noise-generating military activities occur on a regular and frequent basis, some either occur or are more prevalent on a seasonal basis, and some occur only sporadically. Some military activities produce widespread noise effects while the effects of others are limited to selected areas of occurrence. Similar, varied patterns of noise generation are generally true of non-military activities but the overall intensity and distribution of noise effects produced by these activities is less than those produced by military operations.

Although some portions of the range are subject to concentrated noise-causing activities on a frequent daytime basis, no area of the range is continuously subjected to human caused noise with one exception. The exception pertains to perimeter areas of the range located near off-range developments, such as Interstate 8, where noise-causing activities occur on a near continuous basis.

4.20.1.1 Existing Noise Sources and Receptors

Military activities are the predominant sources of noise within the BMGR. Among these activities, the most prevalent source of noise—in terms of the area, frequency, duration, and intensity of effect—is military aircraft flight operations. Although many flight operations are concentrated over selected areas of the range, such as the manned and tactical ranges in BMGR—East and the Moving Sands and Cactus West target complexes in BMGR—West, aircraft overflight noise affects all locations of the range to at least some degree.

Other military training or support operations that generate noise within the range include live ordnance delivery training, vehicle use, portable or fixed-site generator operations, training (inert) ordnance delivery, EOD detonations, munitions and target scrap demilitarization processing, and small arms training. As described in Section 2.2, these military activities only occur within designated areas or at specific locations; ordnance deliveries, for example, occur only within designated weapons ranges and fixed-site generators are operated only at selected instrumentation sites.

Non-military sources of noise within the BMGR include activities performed by civilian government agencies, members of the public, or persons entering the United States illegally from Mexico. Noise is also generated within the range by high-speed highway traffic on State Route 85, which traverses the range from Gila Bend to Ajo, Arizona. Most prevalent among government agency activities are regular low-level helicopter overflights and surface vehicle patrols conducted by the U.S. Border Patrol that are performed to suppress illegal entry to the country. Other government agency activities are performed as required for natural and cultural resources management and civil law enforcement purposes. The principal noise generating activities among these management and enforcement operations involve surface vehicle use but some aircraft overflights are also conducted, usually in support of wildlife management purposes.

The most prevalent and distinctive noise generated by public visitation to the BMGR is that produced by the vehicles that nearly all recreationists use to access the range. Hunters generate some occasional gunfire noise. The BMGR, however, does not provide intensive hunting opportunities and gunfire noise from this activity is seasonally limited as well as sporadic and widely dispersed during hunting seasons. Gunfire noise is also produced on the range by recreational shooters. The BMGR has not been identified, to date, as a popular site for recreational target shooting by individuals or small groups. Noise produced by these recreational shooters has occurred only sporadically. Several organized, recreational machine gun shoots have been conducted within BMGR—West over the last several years by relatively large private parties. This infrequent activity produces noise from automatic weapons fire at a single shooting location over several days.

Vehicle use is the principal source of noise that may be produced by persons illegally entering the United States.

The principle sources of off-range noise that affects portions of the BMGR environment are highway and railroad traffic to the north and highway traffic to the south of the range. Interstate 8 approximately parallels the entire length of the northern boundary of the BMGR at distances from the boundary that vary from zero up to about five miles. The southernmost east-west highway in western Arizona, Interstate 8 is a divided four-lane, limited-access, high-speed highway that carries heavy truck and passenger vehicle traffic. The Southern Pacific Railroad shares roughly the same corridor as Interstate 8 north of the range boundary from the Town of Gila Bend to the east side of the Gila Mountains. Mexico Highway 2 is a two-lane, paved highway that roughly parallels the international border between Sonoyta to San Luis, Sonora. Highway 2 is within one mile of the southern boundary of the BMGR along the international border from the Tinajas Altas Mountains to the western extent of the range. This major highway also carries both heavy truck and passenger vehicle traffic. Noise generated by traffic on these highways and the railroad may be discerned by a listener within the BMGR at varying distances from the highways or railroad depending on atmospheric conditions and the occurrence of competing sources of noise generated within the range. On otherwise quiet nights with either no wind or a gentle wind blowing from the highways or railroad, a listener within the BMGR may discern heavy highway vehicle or train traffic from more than 10 miles inside the range boundary. During days with gusty winds or other atmospheric turbulence and/or if noise is being generated by aircraft, vehicles, or other sources within the range, highway and railway noise from outside the range may not be discernible at the range boundary.

Additional surface sources of off-range noise that may affect border areas of the BMGR include agricultural developments, urban areas, and rural habitation (see Section 4.15). Agricultural croplands have been developed at scattered locations along the western, northern, and southern boundaries of the BMGR. Some of these areas continue to be actively cultivated; others are inactive or abandoned. Heavy agricultural equipment use on active farmlands near the BMGR border may generate noise that periodically affects localized and adjacent areas of the range. Areas of urban development and rural habitation occur in the vicinity of the range near Yuma, Wellton, Tacna, and Gila Bend, Arizona. Noise generated at some of these locations may be perceptible at times within areas of the BMGR.

Some off-range aircraft operations also generate noise that may affect perimeter areas of the range. Included among these operations are military aircraft flights that are entering or exiting the BMGR at medium altitudes or on low-level MTRs. These flights are generally concentrated along designated or prescribed routes. Near-range civil aviation activities that may produce noise effects within perimeter areas of the BMGR include agricultural crop dusting operations and general aviation or commercial airline flights within the low-altitude (below 18,000 feet MSL) federal airway (V-66) that parallels the northern range boundary between Yuma and Gila Bend.

Noise receptors within the range are limited to government personnel with assigned duties, permitted public visitors to the range, and persons who have entered the range (and possibly the United States) illegally, and wildlife. Some Air Force and Marine Corps personnel work at specified locations within the range on a regular daily basis. These locations include Gila Bend AFAF and the range control towers at each of the four manned ranges within BMGR—East and the Cannon Air Defense Complex within BMGR—West. Other personnel—such as EOD teams, target or electronic instrument maintainers, range security officers, and U.S. Border Patrol officers—are present at widely varied range locations on a routine, if not, daily basis. Ground-based military troops involved in training exercises and persons involved in resource management activities are present at dispersed range locations on a regular but more infrequent basis. Permitted public visitors to the range are restricted to selected areas of the range (see Figure 2-4). Most recreational visits to the range occur during the cooler fall, winter, and spring months and on weekends. Illegal entry to the range can occur at any time although it is generally also most prevalent during the cooler periods of the year.

The numbers of people within the range at any one time could vary relatively widely. In absolute terms, however, the maximum occupancy levels reached within the range, which would probably include WTI Course training periods, is likely no more than several hundred. Most of these personnel would be in a few sites including Gila Bend AFAF, the Cannon Air Defense Complex, and occupied Marine Corps ground support areas.

4.20.1.2 Previous BMGR Noise Studies

Existing noise conditions within the BMGR that result from military activities have been estimated or quantified in several studies that assess the environmental effects of existing or proposed military actions (Table 4-44). Most of this work has focused on the noise generated by aviation training operations including subsonic and supersonic aircraft overflights and live ordnance delivery training. Aircraft overflights cause the most widespread, frequent, and, in most locations, intense noise effects that occur on range. The blast noise caused by live ordnance detonations produced the highest sound pressures on the range but the intense noise effects from these explosions are limited to relatively localized areas and occur only sporadically in contrast to aircraft overflight noise. Measurements or estimates have also been made of the noise produced by generators at fixed instruments sites and by some target and munitions demilitarization processes performed at RMCPs. No estimates or measurements have been made of the noise generated by other military operations or non-military activities on the range. Noise from off-range activities has also not been examined with the exception of that noise produced by military aircraft using customary flight tracks to enter R-2301W or MTRs to enter various locations throughout the BMGR.

TABLE 4-44
PREVIOUS BMGR NOISE STUDIES

Previous Noise Study	Study Scope	Noise Metrics Used*
1. *Update to the 1986 Range Air Installation Compatible Use Zone (RAICUZ) Study—Restricted Area R-2301 West MCAS Yuma, Arizona* . (U.S. Navy 1998).	Updated aircraft noise and safety zone analysis for the operation of the Moving Sands and Cactus West target complexes.	▪ Day-Night Average Sound Level (DNL, symbolized as L_{dn}) was used for patterns at Moving Sands and Cactus West target complexes
2. *Marine Corps Air Station Yuma AUX-2 Air Installation Compatible Use Zone (AICUZ) and MCAS Air Installation Compatible Use Zone Update*. (U.S. Navy 1991).	Updated aircraft noise and safety zone analysis for both the continued operation of AUX-2 within the BMGR and MCAS Yuma.	▪ L_{dn} was used for standard flight patterns at AUX-2
3. *Yuma Training Range Complex Final Environmental Impact Statement* (U.S. Marine Corps 1997).	Analysis of aircraft overflight noise for flight operations within the Chocolate Mountain Aerial Gunnery Range, California; BMGR—West; flight corridors to and from these ranges; and WTI overflights of the Cabeza Prieta NWR. Study includes a determination that noise generated by Marine Corps ground operations within the BMGR is non-significant from a regulatory standpoint.	▪ L_{dn} was used for standard flight patterns at AUX-2 and Moving Sands and Cactus West target complexes ▪ Sudden Onset Rate Adjusted Monthly Day-Night Average Sound Level (DNL_{MR}, symbolized as L_{dnmr}) was used for aircraft maneuvers in range airspace and flights on customary flight tracks ▪ C-Weighted Day-Night Average Sound Level (CDNL, symbolized as L_{cdn}) was used for supersonic aircraft operations in range airspace ▪ Sound Exposure Level (SEL) was used to describe the total sound energy produced by a single aircraft overflight event
4. *Air Installation Compatible Use Zone (AICUZ) Study for Gila Bend Air Force Auxiliary Field, Arizona* (U.S. Air Force 1997).	Analysis of aircraft overflight noise and safety zones at Gila Bend Air Force Auxiliary Field.	▪ L_{dn} was used for standard flight patterns at Gila Bend AFAF
5. *Final Legislative Environmental Impact Statement for the Renewal of the Barry M. Goldwater Range Land* Withdrawal (U.S. Air Force 1999).	Analysis includes all subsonic and supersonic aircraft overflight noise within BMGR—West and BMGR—East, subsonic overflight noise generated on MTRs entering the BMGR, and blast noise generated by live ordnance deliveries on designated targets within BMGR—East. Study includes a determination that noise generated by military ground operations and public recreation within the BMGR is non-significant from a regulatory standpoint.	▪ L_{dn} was used for standard flight patterns at Gila Bend AFAF, AUX-2, and Moving Sands and Cactus West target complexes ▪ L_{dnmr} was used for aircraft maneuvers in range airspace and flights on MTRs ▪ L_{cdn} was used for supersonic aircraft operations and high-explosive bomb bursts
6. *Environmental Assessment for the Proposed Flash Burning of Military Munitions Residue at the Barry M. Goldwater Range, Arizona* (U.S. Air Force 2001b).	Study includes measurements/estimates of noise produced by munitions and target scrap demilitarization equipment.	• Raw sound level meter readings in decibels (dB)

TABLE 4-44
PREVIOUS BMGR NOISE STUDIES

Previous Noise Study	Study Scope	Noise Metrics Used*
7. *Noise Effects of Military Overflights on Sonoran Pronghorn* (Krausman and others 2001).	Multi-year, field-based study that examines the effects of noise generated by military overflights and ground-based activities on Sonoran pronghorn within BMGR—East. Study includes field measurements of ambient noise conditions within South TAC Range.	• One-hour and 24-hour Average Sound Levels (symbolized as L_{eq}) were used to assess aircraft noise effects on wildlife • SEL was used to measure the total sound energy produced by a single aircraft overflight event
8. *Final Yuma Training Range Complex Supplemental Environmental Impact Statement* (U.S. Marine Corps 2001).	Estimate of noise produced by fixed-site generators at existing threat emitters within BMGR—West.	• Estimated raw sound levels in dB
9. *Environmental Assessment for the Proposed Installation of Unmanned Threat Emitters and Target Enhancements at the Barry M. Goldwater Range, Arizona* (U.S. Air Force 2001c).	Estimate of noise expected to be produced by fixed-site generators that would power proposed unmanned threat emitters located within BMGR—East.	• Projected raw sound levels in dB

* Further explanation of noise metrics is provided in the following text.

Noise Metrics

Noise, often defined as unwanted sound, is one of the most common environmental issues associated with military activities, particularly those involving aircraft operations. The loudest sounds the human ear can hear comfortably carry one trillion times the acoustic energy of sounds that the ear can barely detect. Because of this vast range, attempts to represent the intensity of sounds using a linear scale become unwieldy. As a result, a logarithmic unit called the decibel (dB) is used to represent sound intensity (also referred to as sound level). A sound level of 0 dB is approximately the threshold of human hearing and is barely audible under extremely quiet listening conditions. Normal speech has a sound level of approximately 60 dB. Humans typically find sound levels above 120 dB to be uncomfortable and higher sound levels cause pain.

Because of the logarithmic nature of the decibel unit, sound levels cannot be added or subtracted directly and are somewhat cumbersome to handle by conventional mathematics. A doubling of sound intensity causes a measured increase in sound level of 3 dB regardless of the initial sound level. For example, 60 dB + 60 dB = 63 dB. The minimum change in sound levels that an average human ear can detect is about 3 dB. A change in sound level of 10 dB is usually perceived by the average person as a doubling (or halving) of the sound's loudness, and this relationship holds true for loud sounds as well as for quiet sounds. A decrease in sound level of 10 dB actually represents a 90 percent decrease in sound intensity, but only a 50 percent decrease in perceived loudness because of the nonlinear response of the human ear.

Two weighting filters, A-weighting and C-weighting, are commonly used in acoustical analysis to measure sound level signals in a manner so that the result more closely approximates the manner in which the human ear perceives sound. A-weighting involves an adjustment of the frequency content of a noise event to represent the way in which the average human ear responds to the noise. C-weighting adjusts sound level signals to better approximate the average human responses to loud, and usually transient, sounds such as those produced by a sonic boom or the detonation of ordnance. C-weighting accounts for the pronounced low-frequency component of explosive sounds, frequently heard as a rumble, that can induce structural vibrations and that may generate additional annoyance to people beyond that caused by the audible component of the sound created by the blast.

While there is no general consensus on either the most appropriate acoustical weighting filter to use in animal studies, or which acoustical metrics best correlate with animal responses to noise, Krausman and others (2001), in a study of noise effects on Sonoran pronghorn, report observations on the merits of each of these filters. They indicate that, in many cases, A-weighting is the most appropriate acoustical weighting filter for investigating sound effects on mammals and that C-weighting may be the best predictor of the response of some animals to loud sounds.

Most noise assessment studies, including those that have been used to evaluate aircraft and blast noise on the BMGR, use standard noise metrics that have been approved by the U.S. EPA and the FAA for modeling the noise produced by the activity of interest. The word "metric" is used to describe a standard of measurement. As used in environmental noise analysis, there are many different types of noise metrics. Each metric has a different physical meaning or interpretation, and each metric was developed through research to use predictive modeling to best represent the effects of noise generated by a particular activity on the environment. Although humans may recognize that the noise generated by multiple events, such as sequential aircraft overflights or bomb bursts, is in fact produced by discrete events that are separated in time, research has shown that noise metrics best represent the effects of sound pressure on receptors in the environment when the noise is assessed in composite as an average sound level over time rather than as time-separated, individual events.

Five noise metrics were used in the various studies listed in Table 4-44 to assess existing noise conditions on or in the vicinity of the BMGR. Three metrics (L_{dn}, L_{dnmr}, and L_{cdn}) were used to model noise from aircraft operations. L_{cdn} was also used to model blast noise from explosive ordnance. Direct measures of aircraft overflight noise was accomplished using two metrics, L_{eq} and SEL. SEL was also used to describe the sound energy produced by a single aircraft overflight based on previously published results.

The metric most frequently used to model noise produced by military aircraft flying prescribed patterns at fixed operating locations, such as at airfields, is the Day-Night Average Sound Level (DNL, symbolized as L_{dn}). This metric was used to model noise generated by aircraft operations

at Gila Bend AFAF, AUX-2, and the Moving Sands and Cactus West target complexes (see Studies 1 and 2 listed in Table 4-44). Based on decades of research on the effects of noise on communities, L_{dn} has become the most widely accepted noise metric for aircraft noise. It correlates well with community response and is consistent with controlled laboratory studies of people's perception of noise. While originally developed for major noise sources, such as highways and airports in populated areas, L_{dn} has also been shown to be applicable to infrequent events (Fields and Powell 1985) and to rural populations exposed to sporadic military aircraft noise (Stusnick and others 1992; Stusnick and others 1993).

The metric used to model noise produced by subsonic military aircraft operating in airspace such as ranges and MTRs is derived from the L_{dn} and is known as the Onset Rate Adjusted Monthly Day-Night Average Sound Level, L_{dnmr}. Both L_{dnmr} and L_{dn} are typically A-weighted. An additional 10 dB is added to both L_{dnmr} and L_{dn} sound levels when aircraft operations occur at night (between 10 p.m. and 7 a.m.) to take into account reduced background noise levels and increased sensitivity to noise at night. Both L_{dn} and L_{dnmr} sum individual noise events and average the resulting level over a specified length of time. Thus they are composite metrics representing the maximum noise levels, the duration of the events, and the number of events. Neither of the cumulative noise metrics represents the variations in the sound levels heard. However, they both provide an excellent measure for comparing noise exposures where sequential noise events, such as from multiple aircraft overflights, are to be considered.

L_{dnmr} also accounts for the surprise or startle effect that results from a high-speed aircraft overflight by adding from a 0- to 11-decibel (dB) penalty for the event, depending on the rate at which noise from the approaching aircraft increases. L_{dnmr} is based on operations during the busiest month of the year (when available) so that predictions are not diluted by seasonal periods of low flight activity.

L_{cdn} is used to model high-energy impulsive sounds produced by supersonic aircraft operations and high-explosive bomb bursts. This metric is effective for accounting for the significantly higher acoustical energy created at low frequencies by these activities than is typical of most aircraft operations.

L_{eq} may be used to measure background noise. In the study to determine the effects of sound on Sonoran pronghorn (see Study 7 in Table 4-44), L_{eq} is defined as the One-hour Average Sound Level and represents the average sound one may hear over a one-hour period (Krausman and others 2001).

SEL is used to describe the total sound energy produced by an individual aircraft overflight event. SEL for aircraft noise is based on the A-weighted sound level integrated over the duration of an event and normalized (or compressed) to one second.

Noise Models

Computer-based noise models were used in the first five of the nine studies listed in Table Noise 1 to describe the noise generated within the BMGR by military activities. The noise models used included NOISEMAP, ROUTEMAP, MR_NMAP, MOABOOM, and BNOISE. The noise data incorporated in the analyses in Studies 6 and 7 were obtained through field measurements on the BMGR. The analyses in Studies 8 and 9 used estimates of potential noise effects that were based on established data for the noise produced by particular types of equipment.

The assessments of aircraft noise exposures around Gila Bend AFAF, AUX-2, and the Moving Sands and Cactus West target complexes (see Table 4-44, Studies 1, 2, and 4) were accomplished using a group of computer-based programs, collectively called NOISEMAP. The NOISEMAP program incorporates the number of daytime (7 a.m. to 10 p.m.) and nighttime (10 p.m. to 7 a.m.) operations, flight paths, and flight profiles (power settings, altitudes, and speeds) to calculate the noise exposure at many points on the ground around the BMGR facilities of interest. NOISEMAP incorporated the L_{dn} noise metric.

Noise levels for subsonic military aircraft operations within the BMGR with no preferred flight tracks were computed using ROUTEMAP in Study 3 and MR_NMAP in Study 5 (Table 4-44). ROUTEMAP and MR_NMAP compute noise based on a uniform distribution of sorties within the range airspace used for the various operations performed. MR_NMAP was also used to calculate noise levels generated within MTRs based on the typical distribution of aircraft about the MTR centerline. Aircraft operational data used for calculating noise levels include aircraft, hours of operation, power settings, speeds, duration, altitude profiles, and sorties. This approach resulted in the presentation of the highest sound levels, expressed as A-weighted L_{dnmr} values, expected from the military flight operations occurring within the BMGR. MR_NMAP was further used in Study 5 to calculate noise levels generated by supersonic aircraft operations within BMGR airspace. In this case, the C-weighted L_{cdn} noise metric was incorporated. MOABOOM was used in conjunction with MR_NMAP to plot elliptical L_{cdn} contours on maps to incorporate noise data in environmental analyses.

BNOISE was used to assess blast noise exposures created from explosive ordnance delivery training at the three HE Hill targets within BMGR—East located in North, South, and East tactical ranges. BNOISE produces L_{cdn} contours. Input data required for modeling this activity included the type of ordnance delivered, the trinitrotoluene (TNT) equivalent explosive charge in each type, the locations of the detonations, and the number of daytime and nighttime events occurring per year.

Noise Assessment Standards

Noise assessment standards that are in common use pertain principally to established noise tolerances for either the workplace or human community land-use compatibility. The origin of the standards can be traced to the federal Noise Control Act of 1972. This Act, among other provisions, directed the Administrator of the EPA to "publish information on the levels of environmental noise, the attainment and maintenance of which in defined areas under various conditions are requisite to protect public health and welfare with an adequate margin of safety." Based on this requirement, the EPA published a report titled *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety* (U.S. EPA 1972). This report identifies two noise metrics—long-term equivalent A-weighted sound level and Day-Night Average Sound Level, or L_{dn}—as being best suited for describing the effects of environmental noise in a uniform manner. Many federal and state agencies, including the DoD and FAA, have accepted L_{dn} as the standard for describing environmental noise impacts. In 1980, the ad hoc Federal Interagency Committee on Urban Noise (FICUN) published guidelines relating L_{dn} to compatible land uses (FICUN 1980). The DoD and FAA have adopted the concept of using land use compatibility, as established by the FICUN guidelines, as the standard accepted measure of aircraft noise effects. The FAA has included the committee's guidelines in the Federal Aviation Regulations (Table 4-45). In 1990, the FICUN reviewed how aviation noise effects are assessed and presented (FICUN 1992). This committee reaffirmed L_{dn} as the best metric for assessing aircraft noise impacts on the environment. The American National Standards Institute (ANSI) also endorsed L_{dn} in 1990 as the "...acoustical measure to be used in assessing compatibility between various land uses and the outdoor noise environment."

TABLE 4-45
LAND USE COMPATIBILITY GUIDELINES*

Land Use	Land-Use Compatibility with Yearly Day-Night Average Sound Levels (L_{dn})			
	60-65	65-70	70-75	75+
Residential				
Low Density	Y†	25 (1)	30 (1)	N
Medium/Low Density	Y†	25 (1)	30 (1)	N
High Density	Y†	25 (1)	30 (1)	N
Recreation Vehicle Parks	Y†	N	N	N
Transient Lodgings	Y†	25 (1)	30 (1)	35 (1)
Group Quarters	Y†	25 (1)	30 (1)	N
Commercial				
Local	Y	Y	25	30
Community	Y	Y	25	30
Regional	Y	Y	25	30
Industrial				
Industrial Park	Y	Y	Y (2)	Y (3)
Light Industry	Y	Y	Y (2)	Y (3)
Heavy Industry	Y	Y	Y (2)	Y (3)

TABLE 4-45
LAND USE COMPATIBILITY GUIDELINES*

Land Use	Land-Use Compatibility with Yearly Day-Night Average Sound Levels (L_{dn})			
	60-65	65-70	70-75	75+
Business				
Office Park	Y	Y	25	30
Administrative	Y	Y	25	30
Public Facilities				
Educational Facilities	Y†	25†	30†	N
Churches	Y†	25†	30†	N
Hospitals	Y†	25†	30†	N
Governmental Services	Y†	Y†	25†	30†
Open Space/Recreation				
Natural Resources	Y†	Y†	Y†	N
Recreational Activities (including golf courses, riding stables, water recreation)	Y†	Y†	25†	30†
Outdoor Sports Arenas, Spectator Sports	Y	Y (7)	Y (7)	N
Tourist Recreation/Commercial	Y	Y	Y	N
Other	Y†	Y†	Y†	N
Highway and Street Right-of-Way	Y	Y	Y (7)	Y (3)
Agriculture				
General	Y	Y (4)	Y (5)	Y (6)
Related Activities	Y	Y (4)	Y (5)	Y (6)

*Adapted from FAR Part 150

Notes:

Y (Yes) Land use and related structures compatible without restrictions.

N (No) Land use and related structures are not compatible and should be prohibited.

† The designation of these uses as "compatible" in this zone reflects consideration of general cost and past community experiences and program objectives. Localities may have different concerns or goals to consider (Federal Interagency Committee on Urban Noise 1980).

25,30,or35 Land use and related structures are generally compatible; measures to achieve noise level reduction (NLR) (outdoor to indoor) of 25, 30, or 35 decibels must be incorporated into design and construction of the structure.

25†,30†,or35† Land use generally compatible with NLR; however, measures to achieve an overall noise reduction do not necessarily solve noise difficulties and additional evaluation is warranted.

Y(#) Yes with restriction. Land use and related structures are generally compatible; per notes 1 through 7 below.

(1) a. Although local conditions may require residential use in these zones, residential use is discouraged in DNL 65-70, and strongly discouraged in DNL 70-75. The absence of viable alternative development options should be determined and an evaluation should be conducted prior to approvals indicating that a demonstrated community need for residential use would not be met if development were prohibited in these zones.

b. Where the community determines that residential uses must be allowed, measures to achieve an outdoor-to-indoor NLR of at least 25 dB (DNL 65-70), and 30 dB (DNL 70-75) should be incorporated into the building codes and be considered in individual approvals. Normal construction can be expected to provide a NLR of 20 dB, thus the reduction requirements are often stated as 5, 10, or 15 dB over standard construction, and normally assume mechanical ventilation and closed windows all year. Additional consideration should be given to modifying NLR levels based on peak noise levels or vibrations.

c. NLR criteria will not eliminate outdoor noise problems. However, building location and site planning, design, and use of berms and barriers can help mitigate outdoor noise exposure, particularly from ground level sources. Measures that reduce noise at a site should be used whenever practical in preference to measures which only protect interior spaces.

(2) Measures to achieve NLR of 25 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas, or where the normal noise level is low.

(3) Measures to achieve NLR of 30 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas, or where the normal noise level is low.

(4) Residential buildings require a NLR of 25 dB.

TABLE 4-45
LAND USE COMPATIBILITY GUIDELINES*

Land Use	Land-Use Compatibility with Yearly Day-Night Average Sound Levels (L_{dn})			
	60-65	65-70	70-75	75+

(5) Residential buildings require a NLR of 30 dB.
(6) Residential buildings are not permitted.
(7) Land use is compatible provided special sound reinforcement systems are installed.

Most studies of noise effects on the environment, including those that support the land use compatibility guidelines provided in Table 4-45, have focused on the extent to which noise may impact human health or cause annoyance among members of a human community. Health impacts studies have focused on two potential problem areas—noise-induced hearing loss and non-auditory health effect factors.

Noise-induced hearing loss is probably the best defined of the potential health effects of human exposure to excessive noise. Federal workplace standards for protection from hearing loss allow a time-averaged sound level of 90 dB over an eight-hour work period, or 85 dB averaged over a 16-hour period. The most protective criterion suggests there will be no measurable hearing loss—at the ear's most sensitive frequency, 4,000 Hz—among the most sensitive portion of a population from noise exposure over a 40-year period if the time-averaged 24-hour sound level has been at or below 70 dB. Since it is unlikely that any one would remain in a time-averaged noise environment exceeding 70 dB for 24 hours per day over an extended time, there is little possibility of noise-induced human hearing loss at noise levels below a day-night average sound level of 75 dB (Wyle Laboratories 1997).

The best scientific review to date of potential non-auditory health effects that may result in humans from long-term noise exposure found that these effects do not occur at sound levels (an average 75 dB for an eight-hour day) that are below those that are protective against noise-induced hearing loss (von Gierke 1990). The non-auditory effects of chronic noise exposure examined in that review were those that were suspected of occurring when noise acted as one of the risk factors in the development of hypertension, cardiovascular disease, and other nervous disorders. Although these findings pertain specifically to noise effects in the workplace, they are equally applicable to those effects that may result from aircraft noise in the community and outdoor environment (Wyle Laboratories 1997).

Annoyance is the primary effect of aircraft noise that is observed in human communities. Disruption of routine activities—such as conversation, telephone use, or radio or television listening—are common examples of annoyance that may result from aircraft noise. Sleep interference is another important source of annoyance associated with aircraft noise. An L_{dn} of 65 dB has been adopted as the upper noise limit that is compatible with all community land uses, including noise sensitive activities such as all residential housing, schools, churches, and

hospitals (see Table 4-45). As a threshold marking the beginning of unacceptable levels of community annoyance, an L_{dn} of 65 dB:

- represents a noise exposure level normally dominated by aircraft noise and not other community or nearby highway noise sources
- reflects the FAA's threshold for grant-in-aid funding of aircraft noise mitigation projects
- marks the eligibility standard established by the U.S. Department of Housing and Urban Development for federally guaranteed home loans

The EPA identified a maximum indoor L_{dn} of 45 dB as necessary to protect against sleep interference (U.S. EPA 1972). Conservatively, assuming that the typical dwelling provides a noise reduction benefit of 20 dB, an indoor L_{dn} of 45 dB means that sleep for the great majority of the community would not be interrupted with an outdoor L_{dn} of up to 65 dB.

The basis for using the 65 dB L_{dn} value as a valid benchmark for comparing and assessing community noise effects and establishing land-use guidelines is based on the best available scientific data, including interpretation of noise levels by the "Schultz Curve" (Figure 4-25). This curve predicts the average response of communities to various noise levels. It was first published in 1978 (Schultz 1978), is widely accepted in the scientific community, and has been updated and validated several times (Fidell and others 1991; Finegold and others 1994). Features represented by this model include a single inflection point – annoyance never falls to zero as noise level decreases (some people are always annoyed), and annoyance never rises to 100 percent as noise level increases (some people are never annoyed, or never complain).

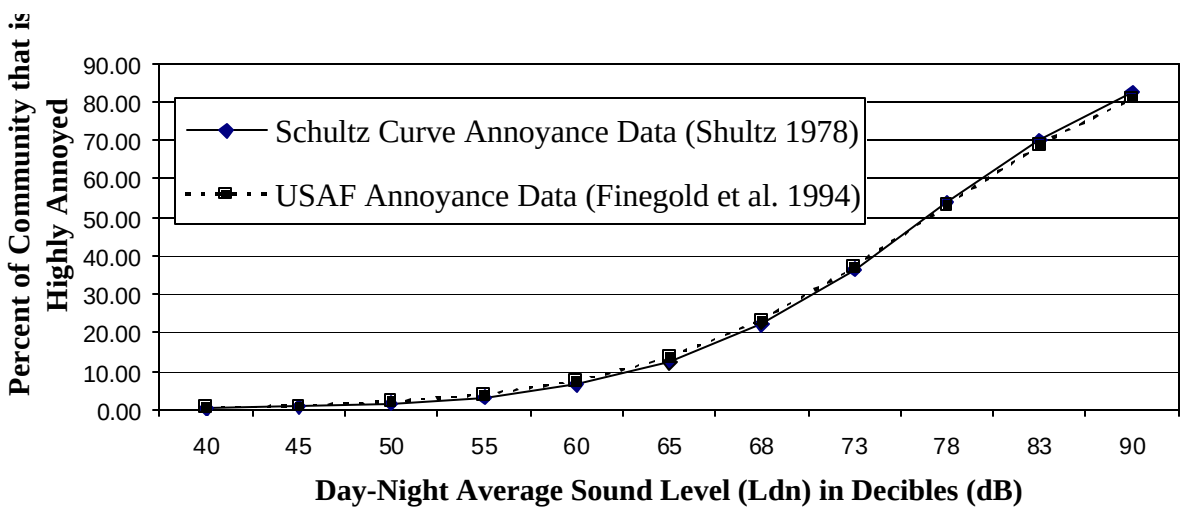
The most common point referred to on the Schultz Curve is 65 dB. The 65 dB L_{dn} value has been recognized as a level which, when exceeded, is normally not compatible with residential land use. This is the benchmark most often applied to determine community land-use compatibility (see Table 4-45).

Although the 65 dB L_{dn} value is a standard that was developed for determining the implications of noise for human health and comfort in communities, this value has also been used extensively as a valid reference point for assessing the effects of human caused noise in rural environments, including the BMGR (see Table 4-44, Studies 1, 2, 3, 4, and 5). In preparing the LEIS for the renewal of the BMGR, however, the Air Force recognized that additional criteria, 55 dB L_{dn} and 45 dB L_{dn}, were also appropriate for assessing noise within the diverse environment in which the range is located (U.S. Air Force 1999). In incorporating additional noise assessment criteria, the Air Force recognized that the BMGR is principally an undeveloped wildland setting with no human habitation but an assigned national defense aviation training mission rather than a community land-use environment. An L_{dn} of 55 dB has been identified by the EPA as a level "...requisite to protect the public health and welfare with an adequate margin of safety" (U.S. EPA 1972). Noise may be heard, but there is no risk to the public or its welfare. Research has shown that at L_{dn} values below 55 dB, the percentage of annoyance becomes progressively lower

(see Figure 4-25). Annoyance never falls to zero at any perceptible L_{dn} value, but at an L_{dn} of 45 dB average noise levels are low enough that most people consider the residual annoyance to be small enough to be negligible.

A noise assessment standard that is being applied in evaluating human caused noise in selected national parks is that of natural quiet. Congress established this standard with the passage of the National Parks Overflights Act of 1987 (P.L. 100-91), which requires the National Park Service to provide for "the restoration of natural quiet and experience" in Grand Canyon National Park and other selected national parks. The passage of this Act was motivated principally by rising levels of aircraft noise generated at Grand Canyon and other parks by growing commercial air tour industries. The noise from air tours was perceived as conflicting with the fundamental purposes of these parks to preserve and protect natural and cultural resources and to provide

Figure 4-25
Response of Communities to Noise
(Adapted from USAF 1999)



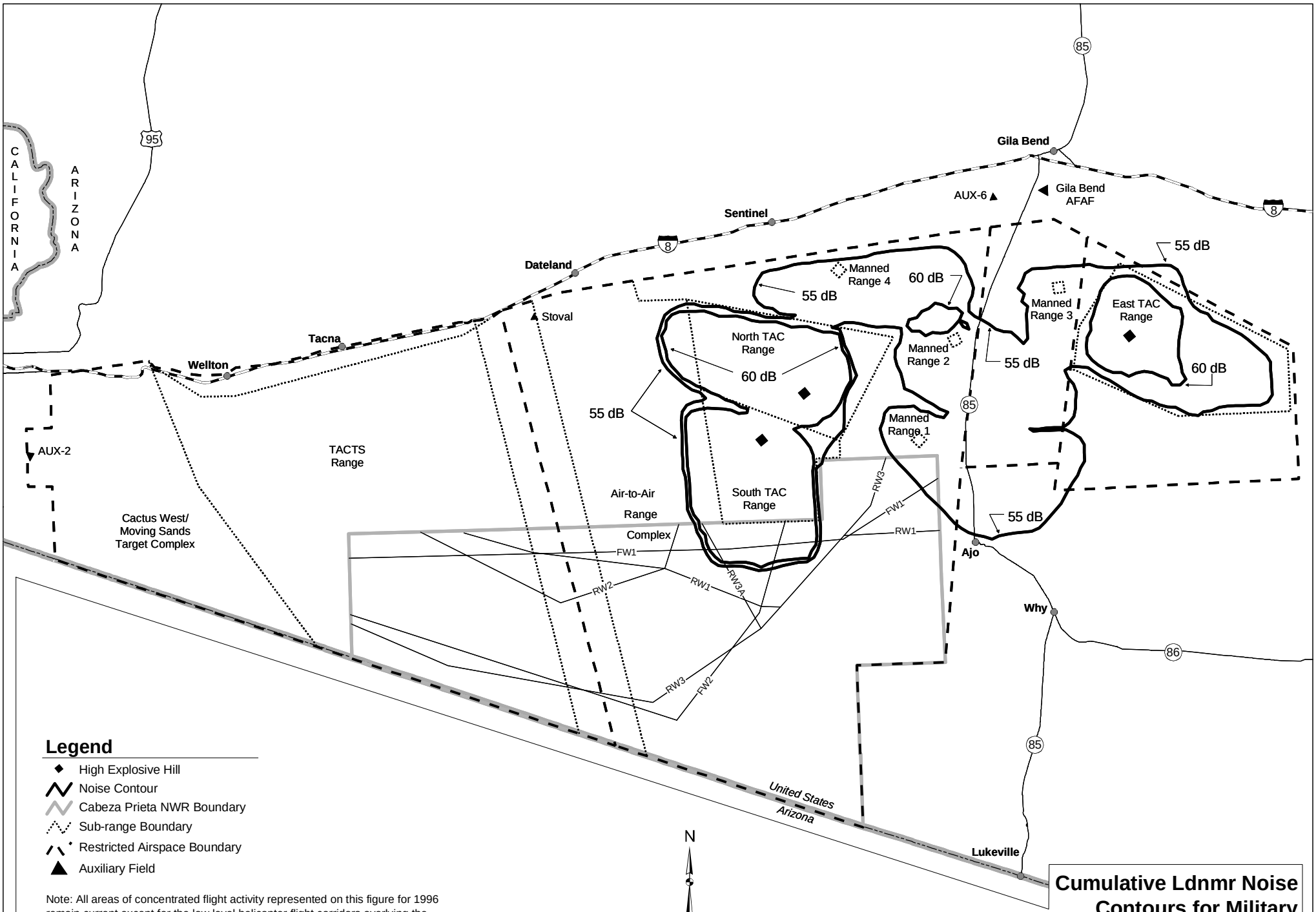
visitors with the opportunity to experience unimpaired natural systems. The natural quiet standard does not provide a single benchmark sound level, such as 65 dB L_{dn}, as a reference point because ambient sound levels from natural causes vary widely depending on topography and the presence of conditions such as flowing water or dense vegetation. Weather events, such as rain, wind, or thunder, also affect natural sound levels. Natural sound levels reported for various undeveloped Grand Canyon National Park locations vary between 10 and 47 dBA, with typical ambient sound levels at these locations ranging between 22 and 41 dBA (U.S. DOI, NPS 1995).

Natural quiet can be experienced within the BMGR. For example, Krausman and others (2001) measured an average 24-hour L_{eq} of 35 dB in South TAC Range for six non-flying weekends. However, a management policy of restoring or maintaining natural quiet would be inconsistent with the Congressionally mandated mission of the range as a military aviation training site. The MLWA of 1999 makes clear that military aviation training is a national priority within the airspace overlying the BMGR and the adjacent Cabeza Prieta NWR/Cabeza Prieta Wilderness. Visitors to these areas may not expect management policies that will necessarily provide an experience of natural quiet and solitude as may be expected within selected national parks.

4.20.1.3 Existing Noise Exposures on the BMGR

Of the nine studies represented in Table 4-44, the Final LEIS for the renewal of the BMGR (Study 5) provides the most comprehensive overview of existing noise exposures on the range. The LEIS incorporates the findings of the RAICUZ study for the Moving Sands and Cactus West target complexes (Study 1), YTRC Final EIS (Study 3), and AUX-2 and Gila Bend AFAF AICUZ studies (Studies 2 and 4). The LEIS also provides the results of new noise modeling for flight operations within R-2301E, R-2304, and R-2505 and explosive ordnance delivery training in BMGR—East; as well as a new cumulative noise exposure analysis that models the noise generated by aircraft overflights and explosive ordnance deliveries in BMGR—East and BMGR—West combined.

The new noise analysis provided by the LEIS is based on aircraft operations within 10 areas of concentrated flight activity within the BMGR for FY 1996 (Figure 4-26). A comparison between the annual aircraft sortie rates at the BMGR for FY 1996 and FY 2000 indicates that the current level of range-wide flight operations has declined 16 percent from the 1996 mark (Table 4-46). A part of this numerical decline is the result of a change in scheduling procedures, which allows the Air Force to more accurately identify training missions that are scheduled but not actually flown as a result of last minute aborts for problems such as aircraft mechanical deficiencies or inclement weather. As reported in the LEIS, fluctuations in the annual volume of flight training performed at the BMGR are to be expected. As evidence of this finding, annual aircraft sortie rates were reported in the LEIS for FY1987 through FY1996. Sortie rates fluctuated over this



Note: All areas of concentrated flight activity represented on this figure for 1996 remain current except for the low level helicopter flight corridors overlying the Cabeza Prieta NWR (RW1, RW2, and RW4). The recent changes in these corridors,

Source: U.S. Air Force 1999

Cumulative Ldnmr Noise Contours for Military Aircraft Operations on the BMGR

Figure 4-26

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time span from a low of 58,056 sorties to a high of 98,785 sorties. The FY2000 sortie rate of 59,782 is within the ten-year range examined in the LEIS (see Table 4-46).

TABLE 4-46
BMGR AIRCRAFT SORTIES RATES IN FY 1996 AND FY 2000

BMGR Airspace Area	Total Aircraft Sorties in FY 1996 and FY 2000			
	FY 1996	FY 2000	Percent Change	Percent Change
BMGR—West (R-2301W)				
TACTS Range	5,950	5,830	-120.00	-2%
Moving Sands	1,861	2,305	444.00	24%
Cactus West	1,354	2,305	951.00	70%
BMGR—West Total	**9,165**	**10,440**	1275.00	**14%**
BMGR—East (R-2301E/R-2304/R-2305)				
North TAC	11,065	9,031	-2034.00	-18%
South TAC	11,936	7,811	-4125.00	-35%
East TAC	7,121	6,743	-378.00	-5%
Range 1	5,079	5,397	318.00	6%
Range 2	5,003	5,576	573.00	11%
Range 3	2,287	2,111	-176.00	-8%
Range 4	4,293	4,421	128.00	3%
Air-to-Air (GRMDS) Range	14,986	8,252	-6734.00	-45%
BMGR—East Total	**61,770**	**49,342**	-12428.00	**-20%**
BMGR Total	**70,935**	**59,782**	-11153.00	**-16%**

The comparison between the FY 1996 and FY 2000 annual sortie data shows that the noise analyses completed for the LEIS continues to be adequate as a representation of average noise exposure levels within the BMGR that occur as a result of aircraft overflights within the 10 areas of concentrated flight activity studied. More recent flight use data also show that aircraft operations at AUX-2 and Gila Bend AFAF are not notably different from those used to develop the AICUZ studies for these installations in 1991 and 1997, respectively (Pearce 2001c, Blake 2001). The principle descriptions of noise exposures, presented in the following sections, for military operations on the BMGR are taken from the LEIS noise assessment and the AUX-2 and Gila Bend AFAF AICUZ studies. Additional noise exposure information on military operations is also taken from the EA for the Proposed Flash Burning of Military Munitions Residue, the EA for the Proposed Installation of Unmanned Threat Emitters and Target Enhancements, the Final YTRC Supplemental EIS, and Krausman and others (2001) (see Table 4-44). The EAs and the Supplemental EIS describe the sound levels that may be expected as a result of generator operations and munitions and target scrap processing. Krausman and others (2001) provide actual measures of ambient sound levels during various periods when military overflights were either present or not present.

Although aircraft and explosive ordnance are not the only military sources of noise on the BMGR, they are the most readily identifiable sources and, with the exception of noise associated

with generator operations and munitions and target scrap processing, are the only noise sources for which exposure levels have been previously developed. Noise from other military sources and from civilian actions was considered to be relatively constant and insignificant within the context of average annual noise levels, and was therefore not quantified in the LEIS and other previous analyses. No estimates or analyses of noise from these previously unquantified sources have been prepared for this EIS.

Subsonic Flight Operations

The mix of military aircraft operated on the BMGR include types that are capable of flying at supersonic airspeeds, such as the F-16 and the F/A-18, and other types, such as the A-10, AV-8B, and all helicopters, that are limited to subsonic airspeeds. Although aircraft with supersonic flight capabilities are used frequently on the BMGR, these aircraft are predominantly flown at subsonic airspeeds. Only about five percent of the sorties in which supersonic capable aircraft are flown involve flight in excess of the speed of sound. More than 98 percent of all types of aircraft operations that currently occur on the range are flown at subsonic speeds.

F-16 and A-10 aircraft collectively account for about 85 percent of the current flight operations within BMGR—East (including R-2301E, R-2304, and R-2305). A variety of other fixed-wing aircraft types account for about 10 percent of aircraft operations within BMGR—East. Twenty-five types of fixed-wing aircraft were operated within BMGR—East in FY 2000. The remaining 5 percent of the operations can be attributed to helicopters. Seven types of helicopters were operated within BMGR—East in FY 2000. Fixed-wing aircraft flight altitudes typically vary from as low as 100 feet AGL up to altitudes over 45,000 feet MSL and at subsonic airspeeds that can exceed 500 knots indicated air speed. Helicopter flight altitudes rarely exceed 1,000 feet AGL or airspeeds in excess of 130 knots.

The primary aircraft types utilized within R-2301W are the AV-8s and F/A-18s, which together accounted for 78 percent of the sorties flown in R-2301W in FY 2000. Other aircraft types flown in R-2301W included the F-5, F-14, F-16, and C-130, which accounted for about 8 percent, 5 percent, 2 percent, and 1 percent respectively of the sorties in FY 2000 The remaining approximately 6 percent of FY 2000 operations flown within R-2301W can be attributed to four helicopter types—AH-1, CH-46, CH-53, and UH-1. The altitudes used by aircraft in R-2301W are similar to those used in R-2301E. The majority of the flight operations are conducted between the hours of 7 a.m. and 10 p.m.

Predicted noise levels reported in the LEIS for subsonic flight operations in BMGR—East during 1996 vary from L_{dnmr} values of 58 dB on Range 1 to 62 dB on both North and South TAC ranges (Table 4-47). North and South TAC ranges had relatively high noise levels due to almost 23,000 flight operations concentrated in a relatively small proportion of BMGR—East. This sound level prediction is consistent with a measured average 24-hour L_{eq} value of 65.3 dB that was reported

by Krausman and others (2001) for the winter of 1999 at a site near the HE Hill target in South TAC range.

TABLE 4-47
MAXIMUM NOISE LEVELS (L_{DNMR}) FOR SUBSONIC AIRCRAFT OPERATIONS AT THE BMGR

Range Location	Restricted Airspace	Sub-Range Area	Maximum L_{dnmr} Level in dB
BMGR-East	R-2301E	Range 1	58
		Range 2	59
		Range 4	59
		North TAC	62
		South TAC	62
		Air-to-Air High	<45
		Air-to-Air Low	49
	R-2304	East TAC	58
	R-2304/R-2305	Range 3	54
BMGR-West	R-2301W	TACTS West of Gila Mts.	<45
		TACTS East of Gila Mts.	<45
		Moving Sands/Cactus West	52

Source: U.S. Air Force 1999

Although the other sub-range areas within BMGR—East had 39,000 operations combined, the predicted noise levels produced by these operations were less than 60 dB because the operations were both dispersed over a much larger area and many were flown at higher altitudes compared to those in North and South TAC ranges. The air-to-air range operations produced the lowest noise levels, 49 dB, because the majority of these operations are conducted at altitudes of between 25,000 and 50,000 feet MSL. At these altitudes, little of the noise produced propagates to the ground.

As shown in Table 4-46, reported flight operations within BMGR—East were 20 percent less in FY 2000 compared to those in FY 1996. While some of this decline is attributed to the improved accounting procedures used in FY 2000 to track sorties actually flown, an overall decline in flight operations still occurred in FY2000 relative to FY 1996. As a result, average noise levels within BMGR—East due to the current level of subsonic flight operations can be expected to be somewhat less than those experienced in FY 1996. Based on FY 2000 sortie rates, the largest decrease in subsonic aircraft noise would be expected in North and South TAC ranges where the largest decrease in operations occurred. The overall level of decrease in operations was not sufficient, however, to change the findings of the LEIS noise modeling appreciably. It is estimated that a 1 to 2 dB decrease in average noise levels may result from new modeling efforts for the BMGR. The smallest change in noise level that can be detected by the human ear is about

3 dB. Thus, the results of the LEIS noise analysis remain representative of the existing noise environment.

The predicted noise levels generated within BMGR—West as a result of subsonic flight operations in FY 1996 was less than that generated within BMGR—East because there were about one-sixth as many total operations. As a result, the corresponding L_{dnmr} levels were also smaller, 49 dB or less for the TACTS Range and 52 dB for the Cactus West and Moving Sands target complexes (see Table 4-47). In general, more noise exists in the vicinity of the Cactus West and Moving Sands target complexes because all of the helicopter operations at this location are flown at 100 and 300 feet AGL, while the majority of the fixed-wing operations take place above 5,000 feet AGL. Although current flight operations within BMGR—West, as represented by FY 2000 sorties, have increased slightly over those reported in FY 1996, this change is not large enough to expect notably different L_{dnmr} predicted noise levels.

Supersonic Flight Operations

Most air combat maneuvering training in R-2301E and R-2301W is performed at subsonic airspeeds. During this training, however, supersonic capable aircraft periodically exceed the speed of sound for short bursts of time resulting in what is commonly known as a sonic boom. Approximately five percent of the air combat maneuvering sorties flown by F-16s in the Air-to-air Range of R-2301E involve supersonic flight. Supersonic flight operations also occur in R-2301W, primarily by F/A-18 aircraft in the TACTS Range. Approximately five percent of all F/A-18 flight operations include supersonic airspeeds during a portion of routine air combat maneuvering training. Supersonic flight by F-16 and F/A-18 aircraft typically occurs for 5 to 10 seconds at a time for a total of 50 seconds per sortie. Although sustained supersonic speeds in excess of an average of 50 seconds per sortie do occur during post maintenance functional check flights, these flights normally occur above 30,000 feet MSL and were not included in noise models developed for the BMGR because the resulting sonic booms frequently do not propagate to the ground.

Based on FY 1996 operational data, the average level of noise contributed by supersonic aircraft operations at the BMGR was reported to be minimal in the LEIS for the renewal of the range (U.S. Air Force 1999). Although the floor for supersonic operations in R-2301E is 5,000 feet MSL and no floor has been established for supersonic operations in R-2301W, supersonic flight operations typically occur above 10,000 feet MSL in both restricted airspace areas. An average of one supersonic flight per day was estimated to occur in the Air-to-air Range of R-2301E based on available information on F-16 air combat maneuvering training activities. Supersonic flights in the TACTS Range of R-2301W were estimated to average less than one event per day. Although each supersonic flight could result in multiple sonic booms, this level of supersonic flight would result in an average of less than 10 sonic booms per day in these areas. Under these

flight conditions and due to the relatively low number of operations, the L_{cdn} levels resulting from these operations would be less than 45 dB in both R-2301E and R-2301W.

The effects of supersonic flight at ground level can also be expressed in pounds per square foot (psf) of overpressure for each sonic boom event. For example, an F-16 flying straight and level at 10,000 feet AGL at Mach 1.3 (i.e., 1.3 times the speed of sound) would typically create an overpressure of 4.6 psf. This overpressure level would be considerably less than that experienced at a large-scale public fireworks display (Maglieri and Henderson 1973).

Cumulative Noise Exposure from Military Flight Operations in the BMGR

Cumulative L_{dnmr} contours of 55 dB and greater were identified in the LEIS noise analysis for subsonic and supersonic aircraft operations within the BMGR (Figure 4-26). These contours depict the noise impacts associated with all flight activity within BMGR sub-range areas, MTRs that enter BMGR airspace, and the low-level flight corridors overlying the Cabeza Prieta NWR that are use during the Marine Corps WTI Course. Flight activities at Gila Bend AFAF and AUX-2 were not included in the development of the contours.

The LEIS noise analysis found, based on FY 1996 operational data, that North, South, and East TAC ranges and an area northwest of Manned Range 2 constitute the only locations within the BMGR where flight activities are concentrated enough to generate annual average noise contours (L_{dnmr}) that exceed 60 dB. Flight activities at Manned Ranges 1, 2, 3, and 4 were sufficiently concentrated to generate annual L_{dnmr} contours of 55 dB or higher. The tactical and manned ranges may individually and cumulatively have L_{dnmr} noise levels that range up to 65 dB, but no higher as no 65 dB contours were produced. No cumulative noise contours of 55 dB or higher were found to be associated with any of the MTRs or WTI corridors on the BMGR or with the Air-to-air Range within R-2301E or the TACTS Range and Moving Sands and Cactus West target complexes within R-2301W. This is due to the lower levels of concentrated flight operations that occur in these airspace units on an annual basis. Average annual noise exposures in excess of 55 dB do occur in the immediate vicinities of AUX-2 and Gila Bend AFAF, but these exposures are reported from the results of separate analyses, as described later in this section.

The volume of civil flight operations within BMGR airspace in 1996 by the U.S. Border Patrol, AGFD, and others was not adequately characterized for inclusion in the development of the cumulative noise contours. Compared to the levels of military flight operations that occur at the BMGR, the volumes and concentrations of civil flight activities are not likely to be sufficient to influence the distribution or magnitude of L_{dnmr} contours of 55 dB or higher.

Explosive Ordnance Operations

Routine aircrew training within BMGR—East that involves the delivery of live explosive ordnance takes place at the three HE hill targets located within East, North, and South TAC ranges and at the live maverick missile targets in North and South TAC ranges. Air-to-ground delivery of live explosive ordnance is not currently authorized within BMGR—West.

Ordnance delivery at the three HE hills currently occurs exclusively during the period of 7 a.m. to 10 p.m., which avoids the application of the nighttime (10 p.m. to 7 a.m.) noise penalty. The most frequently used ordnance at these targets includes MK-82s (500-pound bombs) and MK-84s (2,000-pound bombs). The detonation of an MK-82 bomb releases less energy, and thus makes less noise, than does an MK-84, but MK-82s are used more than twice as frequently as MK-84s. A combined total of 1,665 MK-82 and MK-84 bombs were dropped on the three HE targets in FY 1996. A combined total of 74 live maverick missiles were delivered in FY 1996 on the two live maverick missile targets.

Based on the 1996 data, noise exposures resulting from explosive ordnance deliveries at the three HE targets was calculated to have L_{cdn} levels of 88, 93, and 85 dB, respectively, at the center of each of the three targets (U.S. Air Force 1999). The annual volume of live maverick missiles delivered was insufficient to generate L_{cdn} noise exposures that were above 45 dB. Although the volume of explosive ordnance delivered at each of the ranges varies somewhat from year to year, the 1996 data are representative of current delivery operations. The noise levels associated with explosive ordnance delivery are diminished significantly with increasing distance. For example, noise levels are reduced by approximately 6 dB within half a mile from the target center and are further reduced a total of 15 dB within one mile. The area exposed to blast noise within the 62 dB L_{cdn} contour for East TAC Range is about 6,917 acres. The 62 dB L_{cdn} exposure areas within South and North TAC ranges are slightly smaller.

Noise Exposures for Gila Bend AFAF and AUX-2

Both the Gila Bend AFAF and AUX-2 auxiliary airfields are used to support operations that either cannot be conducted at primary airfields due to location, limited capacity, safety concerns, or operational requirements. AICUZ studies were prepared for these installations in 1997 and 1991, respectively (see Table 4-44, Studies 2 and 4). The noise exposure findings from the studies continue to be representative of current operations.

Gila Bend AFAF is maintained and operated primarily to support training involving F-16 and A-10 aircrews from Luke and Davis-Monthan AFBs, respectively, and ARNG helicopter aircrews from the WAATS. F-16 and A-10 aircrews use Gila Bend AFAF primarily as an outlying field for practicing landing and takeoff traffic pattern and emergency procedures. ARNG aircrews use Gila Bend AFAF as a forward operating area to refuel and rearm helicopters that are being used

in training on the BMGR. In addition, this auxiliary airfield is used for emergency or precautionary recoveries of military aircraft that experience malfunctions or are damaged during operations on the BMGR. A noise analysis was conducted for the airfield as part of the Gila Bend AFAF AICUZ study. Noise exposure levels associated with aircraft operations at Gila Bend AFAF vary from more than 80 dB primarily within the installation boundary to 65 dB or higher within other areas of the installation, BMGR locations north and south of the installation, and public and private lands outside of the BMGR to the north and east of the installation (Figure 4-27).

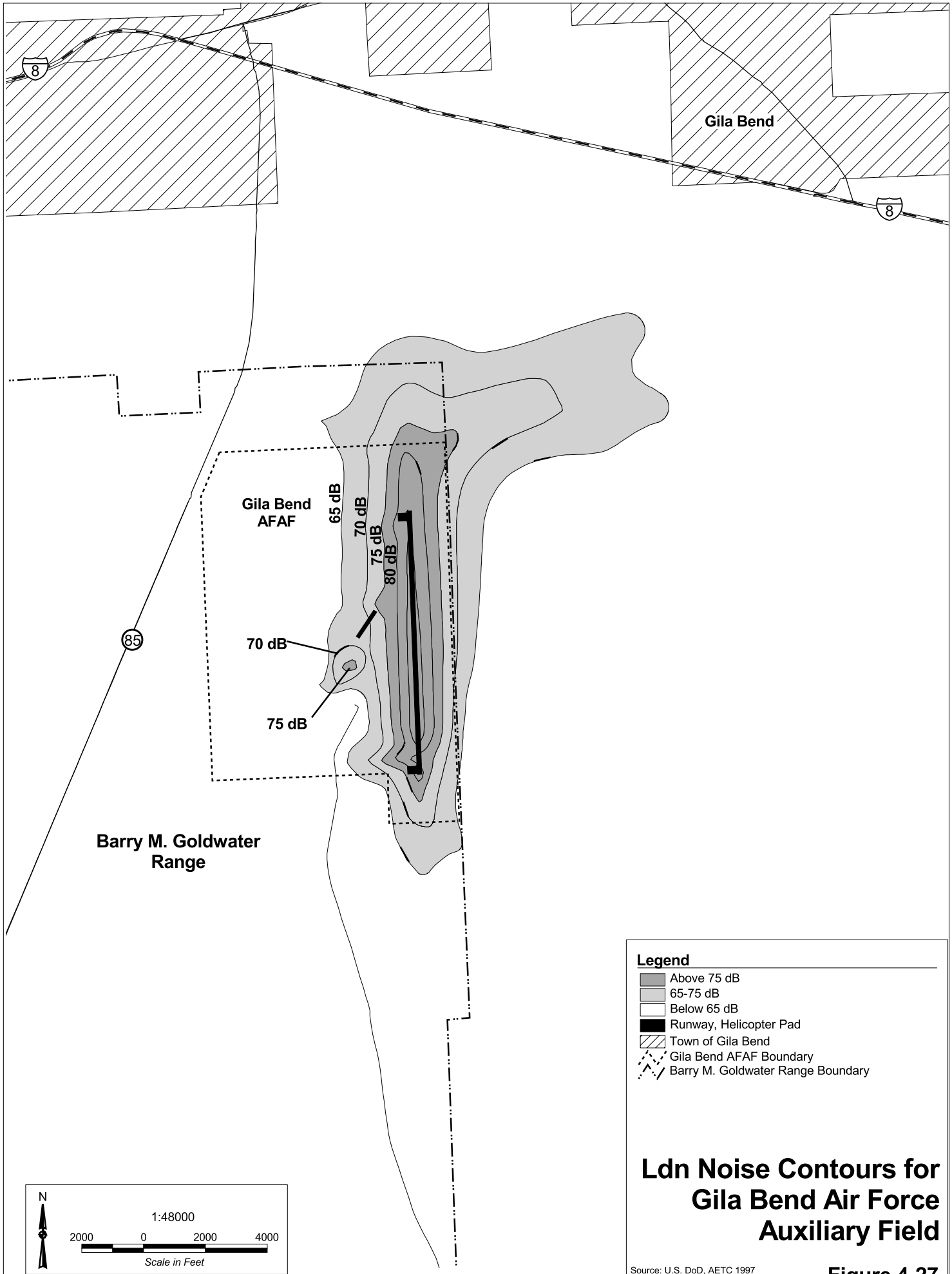
AUX-2 serves as an outlying airfield to support training operations originating from MCAS Yuma. About 97 percent of the flight activity at AUX-2 is conducted by AV-8 aircraft. Other flight operations are performed at this field by C-130s and various helicopter types. Most AV-8 activity at AUX-2 involves field carrier landing practice (FCLP) operations that simulate landing on an aircraft carrier. FCLP operations typically involve several aircraft flying at low altitude and in almost circular patterns. These operations are often conducted at night to prepare aircrews for operational deployments aboard U.S. Navy aircraft carriers. The noise levels associated with these operations range from above 80 dB adjacent to the runway environment down to 60 dB normally within 2.5 miles of the runways (Figure 4-28). One exception is the noise associated with the nighttime FCLP flight track that extends due west of the airfield. Noise associated with this flight track extends about five miles west of the BMGR land boundary.

Noise Exposures from Selected Ground-Based Military Operations

Measurements or estimates have also been made of the noise produced by generators at TACTS Range threat emitter sites in BMGR—West, target and munitions demilitarization processes performed at RMCPs in BMGR—East, and mobile and planned fixed-site threat emitters in BMGR—East. No estimates or measurements have been made of the noise generated by military vehicle use or other ground-based military operations on the range.

The noise produced by generators at fixed and mobile threat emitter sites was estimated in 2001 in the Final YTRC Supplemental EIS (see Table 4-44, Study 8). Mobile threat emitters are powered by 6- or 10-kilowatt generators that typically produce 80 dBA of noise at 15 feet and 40 dBA at 90 feet. Spring 2001 use figures for the mobile threat emitters show that one of the six mobile emitter sites is typically active for seven hours per month and the other five sites are typically active for 14 hours per month.

Fixed threat emitter installations have been developed at eight sites within BMGR—West. The threat emitter at each site is powered by a 20-kilowatt generator. The noise signature of the 20-kilowatt generator is 81 dBA at 10 feet and 40 dBA at 80 feet. Each fixed threat emitter generator typically operates for 40 hours per month.



Ldn Noise Contours for Gila Bend Air Force Auxiliary Field

Source: U.S. DoD, AETC 1997
in U.S. Air Force 1999

Figure 4-27

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Legend

- Above 75 dB
- 65-75 dB
- Below 65 dB
- Restricted Airspace Boundary
- BMGR Land Boundary

1 0 1 2

Scale in Miles

N

Ldn Noise Contours for Auxiliary Field 2

Source: U.S. DoD, Southwest Division
Naval Facilities Engineering Command
1993 *in* U.S. Air Force 1999
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Figure 4-28

Two mobile threat emitters are also used at various locations within North, South, and East TAC ranges (see Table 4-44, Study 9). Specific noise exposure estimates have not been prepared for the generators that power these emitters, but exposures similar to those produced by the TACTS range mobile threat emitters are likely. The construction of new fixed-site threat emitters are planned at two sites within North and South TAC ranges combined and at two sites within East TAC Range. Noise exposures similar to those produced at fixed-site threat emitters within BMGR—West are anticipated.

Target and munitions demilitarization processing is performed at the four RMCPs in BMGR—East. Luke AFB personnel monitored the noise generated by this process at RMCP 1 during a period of active scrap loading and during a period of active bomb cutting. Noise levels were measured in eight-second intervals at positions located a distance of about 60 feet apart in an arc with a radius of 300 feet from the three main noise-sources (scrap loading, bomb shearing, and generator—see Appendix B). The maximum noise levels measured from these positions during the eight-second intervals were recorded. The maximum noise levels measured during scrap loading activity ranged from 46.6 dB at 300 feet northeast of the generator to 64.2 dB at 300 feet west of the scrap loading activity. The maximum noise levels measured during the bomb shearing activity ranged from 50.4 dB at 300 feet south of the generator to 78.7 dB at 300 feet northeast of the shearing equipment (Luke AFB 2000d).

Noise levels associated with the crushing and shredding process used to demilitarize BDU-33 practice bombs have been found to be 86 dB at 10 feet from the operating equipment and 84 dB at 50 feet from the equipment (Construction Equipment Company 1995).

4.20.2 Interrelationship Between the Military Mission and Noise Management

The military activities—such as aircraft flight operations, explosive ordnance detonations, surface vehicle use, and small arms fire—that are performed on the BMGR unavoidably generate noise. As documented in Section 4.20.1.1, military activities are the predominant source of noise within the BMGR. These activities and the noise they produce, however, are consistent with the fundamental land use purposes for which the BMGR was established. A fundamental purpose of the proposed INRMP is to direct the management of natural resources on the range in such a manner that there is no net loss in the capability of the range to continue to support its military mission. From the perspective of noise management, the proposed INRMP should prescribe only those non-military land uses that are compatible with noise that may be generated by current or future military activities. Should a conflict arise between noise generated by military activities and an existing or proposed non-military land use, the management priorities established by the proposed INRMP must be the continued support of the military mission.

A second fundamental purpose of the proposed INRMP is to direct the management and conservation of natural and cultural resources in such a manner that the effects of noise generated by military activities on these resources is minimized. The noise generated by current military actions is not known or believed to cause significant adverse effects on these resources. The collective natural resource goals established in this EIS for the proposed INRMP are designed to maintain or improve the health of the BMGR ecosystem and its components to an extent that noise effects on this system do not rise to a significantly adverse level.

4.20.3 Existing Regulatory and Statutory Requirements and Management Plans and Actions

Current noise management issues within the BMGR include the protection of personnel and visitors from harmful noise levels and concerns about the effects of noise on wildlife. The protection of human noise receptors is not a direct natural resources management issue and is not a requirement of the proposed INRMP. Military and other personnel supporting DoD or other agency missions that are required to work in localized BMGR locations where excessive noise levels may occur are provided with hearing protection as prescribed by occupational safety requirements. Some of these locations include the vicinities of the active runways at Gila Bend AFAF or AUX-2, at one of the two small arms ranges, or at a RMCP.

Nevertheless, the proposed INRMP will provide the policy basis under which public visitation to the range will be permitted and managed. From this perspective, the INRMP must provide policies regulating public visitation that are consistent with requirements to protect public safety. Restrictions on general public visitation to hazardous areas of the range, such as the tactical and manned ranges within BMGR—East and the Moving Sands and Cactus West target complexes in BMGR—West, are prime examples of essential public safety policies that must be incorporated in the proposed INRMP. These entry restrictions are in place to protect the public principally from hazards associated with the use of military munitions and lasers. At this time, the noise exposure levels that occur within BMGR locations that are open to general public visitation are well within all regulatory guidelines for protecting human health. Thus, there is no current requirement to further restrict public visitation in these locations for the purposes of protecting public health from hazardous noise conditions.

A future military mission could conceivably emerge that could generate hazardous noise exposure levels within locations currently open to general public visitation. Reasonable steps would be taken during the planning and environmental impact assessment process for such a mission to avoid, minimize, or mitigate hazardous noise exposure levels. As explained in Section 4.20.2, however, conflicts between a proposed military activity and public visitation would have to be resolved in favor of the interests of the military mission. Public visitation would have to be curtailed to the extent necessary to make this activity compatible with a proposed military

mission if the purpose of and need for the military activity could not be met without producing noise exposure levels that would be incompatible with public health.

Management policies that would require modification of military missions to protect the quality of a visitor's outdoor experience within the BMGR are also inappropriate for the proposed INRMP. As indicated in Section 4.20.1.2, noise management standards that require the restoration or maintenance of natural quiet are inconsistent with the military purposes of the BMGR.

The potential for noise to harm wildlife is an ongoing natural resource management issue, but all available evidence indicates that BMGR wildlife populations and its ecosystem are not being adversely affected by the existing noise conditions within the range. The principal concerns that have been expressed regarding the potential for noise to harm wildlife have focused on two protected species, Sonoran pronghorn and lesser-long nosed bat. As explained in Section 4.7, recent research by Krausman and others (2001) provides strong evidence that noise generated by military activities within the BMGR is not influencing the Sonoran pronghorn in a detrimental manner. This research has generally demonstrated that noise from fixed-wing aircraft overflight activities is not causing significant harm to this species. Some concern remains, however, about potential adverse effects from noise caused by low-level helicopter overflights. Krausman and others (2001) were unable to collect sufficient numbers of observations in their study area of interactions between Sonoran pronghorn and low-flying helicopters. Military helicopter sorties of all types combined represent a minor proportion of all aircraft flight operations in the BMGR. Helicopter sorties accounted for about 5 percent of all flight operations in BMGR—East in FY 2000. Although there is no evidence that helicopter overflights have caused injury or other harm to Sonoran pronghorn, the alignments of some low-level helicopter overflight corridors used for the semiannual Marine Corps WTI Course have been adjusted three times—in 1988, 1994, and 2001—as precautionary measures aimed at reducing potential chance encounters between helicopters and pronghorn during the spring fawning season. For similar reasons, a low-level helicopter overflight corridor was realigned in 1994 to avoid potential noise induced disturbance of a known lesser-long nosed bat maternity roost in the Growler Mountains.

4.20.4 Information Not Currently Available to Support Noise Management

The only specific unavailable information identified during the preparation of this EIS with implications for the future management of noise within the BMGR pertains to potential noise effects on Sonoran pronghorn resulting from low-level helicopter flight operations. Project numbers 16 and 29 identified in the Final Revised Sonoran Pronghorn Recovery Plan (USFWS 1998a) and a proposed conservation measure identified in the remanded USFWS biological opinion on the Western Army National Guard Aviation Training Site Expansion Project identify a need for further study of the effects of helicopter overflights on Sonoran pronghorn (USFWS

2001c and 2002b). Research completed to date does not provide definitive data on how low-level helicopter overflight noise may affect this endangered species (Krausman and others 2001). This does not constitute incomplete or unavailable information needed to conduct the environmental impact analysis presented in Chapter 5 in accordance with 40 CFR §1502.22.

4.21 ENVIRONMENTAL JUSTICE

4.21.1 Background

Environmental justice refers to the right to a safe and healthy environment for all and the conditions in which such a right can be freely exercised regardless of race, ethnicity, and socioeconomic status. Federal agencies most commonly use the definition for environmental justice offered by EPA, which is:

> The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no group of people, including racial, ethnic, or socioeconomic group, should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local, and tribal programs and policies. [34]

Executive Order 12898

On 11 February 1994, President Clinton issued E.O. 12898 addressing environmental justice with an accompanying memorandum to the heads of all federal departments and agencies. The memorandum states:

> [The order] is designed to focus federal attention on the environmental and human health conditions in minority and low-income communities with the goal of achieving environmental justice. [The order] is also intended to promote nondiscrimination in Federal programs substantially affecting human health and the environment and to provide minority and low-income communities access to public information on, and opportunity for public participation in, matters relating to human health and the environment.

[34] Environmental justice has been defined somewhat differently by various scholars and organizations. The terms "environmental racism" and "environmental equity" have also been used in place of environmental justice.

The E.O. charged each federal agency with making the achievement of environmental justice part of its mission by "identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations."

Specific actions of the E.O. were directed at NEPA-related activities and included:

- when NEPA requires an analysis of environmental effects, each federal agency must analyze the health, economic, and social effects of a proposed action on minority populations and low-income populations

- mitigation measures outlined in NEPA documents should, whenever feasible, address significant and adverse effects of proposed federal actions on minority populations and low-income populations

- the public participation component of NEPA must include identifying potential effects and mitigation measures in consultation with affected communities and improving the accessibility of public meetings, official documents, and notices to affected communities

4.21.2 Interrelationship Between the Military Mission and Environmental Justice

Environmental justice effects, with regard to the renewal of the BMGR land withdrawal and the associated continuation of military operations, were examined in the *Final Legislative Environmental Impact Statement for Renewal of the Barry M. Goldwater Range Land Withdrawal* (U.S. Air Force 1999). After considering the environmental effects of all resources, this analysis found that noise from military aircraft operations was the only environmental effect that extended beyond the range boundary and affected residences. With the proposed action to renew the land withdrawal, noise was the only resource that had the potential to have an environmental justice effect that could affect minority populations, low-income populations, or a Native American tribe. While continued flight operations at the BMGR were included as part of the range renewal and were found to have some continued affect on noise resources near the BMGR, the analysis found that range renewal and the associated military operations would not result in environmental justice implications.

4.21.3 Existing Regulatory and Statutory Requirements and Management Plans and Actions

As noted in the discussion of the background for environmental justice in Section 4.21.1, E.O. 12898 initiated the responsibility for considering environmental justice effects in NEPA-related actions.

To complement E.O 12898, the CEQ released *Environmental Justice Guidance Under the National Environmental Policy Act* in December 1997 to further assist federal agencies with their NEPA procedures so that environmental justice concerns are effectively identified and addressed. In November 1997, the Department of the Air Force released an Interim Guide for Environmental Justice Analysis with the Environmental Impact Analysis Process.

4.21.4 Information Not Currently Available to Support Environmental Justice Management

No specific data or information needs pertaining to the environmental justice implications of managing the natural and cultural resources of the BMGR were identified during the preparation of the affected environment section of this EIS.