

***Renewal of the Barry M. Goldwater Range Land Withdrawal
Draft Legislative Environmental Impact Statement (LEIS) Frequently Referenced Information***

LEIS Purpose

This draft LEIS addresses the proposed renewal of the military land withdrawal and reservation for the Barry M. Goldwater Range (BMGR). Renewal of the land withdrawal is required by the Military Land Withdrawal Act of 1986 (Public Law 99-606) if the military proposes to continue military use of the lands after 6 November 2001.

The purpose of and need for renewing the BMGR land withdrawal is to preserve a component of the national defense training base for the continued and future readiness of America’s air forces to defend the security of the nation and its interests.

Lead Agency and Cooperating Agencies

The lead agency is the Department of the Air Force. Cooperating agencies are the Department of the Navy, Bureau of Land Management, and U.S. Fish and Wildlife Service.

Frequently Referenced Figures and Tables

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LEIS Contents

- **Executive Summary**—provides a concise synopsis of the LEIS analysis and conclusions.
- **Chapter 1**—describes the purpose of and need for the renewal of the land withdrawal as well as other introductory background information.
- **Chapter 2**—describes the proposed action, alternatives, and sub-alternatives (or scenarios).
- **Chapter 3**—describes the baseline environment that may be affected by the alternatives.
- **Chapter 4**— reports the projected environmental consequences for the proposed action, alternative action, and no-action alternative.
- **Chapter 5**—reports the probable environmental consequences of each of the renewal sub-alternatives for military administration, withdrawal land area, and administration of natural and cultural resources.
- **Chapter 6**—addresses the possible cumulative effects (additive or interactive) that would result from the incremental impact of the proposed action when added to other past, present, and reasonably foreseeable future actions.
- **Appendices**—provide other background information and supporting data.

1.0 PURPOSE OF AND NEED FOR ACTION

Training is everything to us. If we can train to the point where we know our aircraft, our weapons, and our tactics inside-out, then we can beat anybody. But we have to be able to train in the aircraft in an environment that is as realistic as possible. We have to be able to train the way we expect to fight. Otherwise, we will fail in combat. It's just that simple.

Capt. Tom Abbot, U.S. Air Force, F-16 pilot and Persian Gulf War Veteran, interview in *Training America's Airpower. The Barry M. Goldwater Range at the Forefront* 1996. Video produced by 56th Fighter Wing (FW), Luke Air Force Base (AFB).

Untutored courage is

useless in the face of educated bullets.

General George S. Patton, Jr., *Cavalry Journal*, April 1922 (in Tsouras 1992).

[The fact that U.S. ground troops have not been attacked by enemy aircraft in more than 45 years]...did not happen just by luck
General Ronald R. Fogleman, 1997, Air Force Chief of Staff. 1994-1997, in *Air Force Magazine* (1997b).

Train like you will fight, fight like you trained.
Warrior's maxim.

1.1 INTRODUCTION

The United States Congress faces a decision that will affect the ability of the U.S. Air Force and the other armed services to train military aircrews¹ how to fly, fight, and survive in combat. The

¹ Aircrew refers to the crew members that 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 system 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.

pending congressional decisions are whether or not to reauthorize any or all of six military reservations authorized by the Military Lands Withdrawal Act of 1986 (Public Law [P.L.] 99-606). To quote P.L. 99-606, two of the affected reservations²—the Barry M. Goldwater Air Force Range (BMGR) in Arizona and Nellis Air Force Range (NAFR) in Nevada—are: “...reserved for use by the Secretary of the Air Force forX

- (A) an armament and high-hazard testing area;
- (B) training for aerial gunnery, rocketry, electronic warfare, and tactical maneuvering and air support; and
- (C) subject to the requirements of Section 3(f), other defense-related purposes consistent with the purposes specified in this paragraph.”

As specified in P.L. 99-606, authority for each of the six military reservations will expire on 6 November 2001 unless Congress acts to renew the land withdrawal applicable to each reservation. P.L. 99-606 also directs that the secretary of the military department concerned shall publish a draft environmental impact statement (EIS) by 6 November 1998 addressing the proposed renewal of any portion of any of the military reservations authorized by that act for which there is a continuing military need beyond 6 November 2001.

The NAFR and BMGR together represent more than 60 percent of the total range land area assigned to the Air Force. These ranges are essential to the continuing ability of the Air Force to meet its national defense responsibilities. The Air Force has stated that there is a continuing need for both of these ranges and is publishing a separate draft legislative EIS (LEIS) for the proposed renewal of each range. This draft LEIS is being submitted to Congress and is available for public review. An LEIS has been prepared (rather than an EIS) because Congress will decide which alternative will be implemented and will enact new legislation if that decision is to renew the BMGR. This draft LEIS addresses the proposed renewal of the BMGR, which is administered by the U.S. Air Force, Air Education and Training Command, through the 56th FW, 56th Range Management Office at Luke AFB, Arizona. The NAFR is administered by the U.S. Air Force, Air Combat Command, though the Air Warfare Center, 99th Air Base Wing, 99th Range Group, and 99th Range Squadron at Nellis AFB, Nevada.

This chapter addresses the purpose of and need for renewing the land withdrawal and reservation.

1.2 PRESERVING THE TRAINING BASE

As the twentieth century draws to a close, the United States has emerged as the world’s preeminent military power. This strength is the result of many factors; some have been fortuitous, but without a doubt the ascendancy of American military power “did not happen just

² The other four reservations include (1) the Bravo-20 Bombing Range in Nevada reserved for use by the Secretary of the Navy and (2) the McGregor Range in New Mexico, (3) the Fort Greely Maneuver Area/Fort Greely Air Drop Area in Alaska, and (4) the Fort Wainwright Maneuver Area, also in Alaska, reserved for use by the Secretary of the Army.

by luck” (to quote General Fogleman). Among the many contributing issues, three stand out: (1) the American military attracts quality people with an earnest commitment to service; (2) the nation has worked diligently to keep its warfighting arms technologically competitive if not superior, and (3) the U.S. military has a clear focus on the indispensable importance of training for maintaining a strong and capable force that is well prepared to respond to the nation’s defense needs.

The United States ended its military draft at the close of the Vietnam War and converted to an all volunteer military force. The success of the voluntary service in attracting well-qualified men and women in sufficient numbers to field the world’s best armed forces has been well publicized. Also widely circulated are accolades about the prowess of American weapons. Far less known publicly, but well regarded among military professionals world-wide, is the emphasis that the American military places on high-quality, thorough training. Training quality has been the difference between victory and defeat countless times throughout the history of warfare. Surprisingly often, a force with superior numbers and equipment has fallen to a smaller force that had inferior weapons but was better trained for the battle at hand.

Nowhere is the critical importance of training more evident than in aerial warfare. Combat in aircraft that can aggressively maneuver to destroy other aircraft, attack an enemy on the ground or at sea, ferry troops or supplies in and out of forward battle areas, or perform reconnaissance of an enemy’s position and strength is a phenomenon born of this century. By the very nature of aircraft and flying alone, it is among the most technologically advanced and tactically challenging forms of warfare. The ever increasing sophistication of combat aircraft and the weapons systems used by and against them has made thorough, ongoing training essential for military aircrews. No participant in any form of tactical aviation³ is likely to survive, much less prevail in combat, without adequate training. The sophistication of aircraft and weapons system technology cannot be counted on to compensate for inadequate training. Aircrews must know every aspect of their aircraft and weapons in order to employ them successfully in combat. It is also paramount that aircrews receive ongoing training throughout their military flying career. Combat flying skills are highly perishable and can be effectively developed and maintained only through an ongoing program of frequent training that is realistic to the tactical missions aircrews are expected to perform.

³ Tactical aviation refers to the whole spectrum of moves and counter-moves that aircrews and aircraft perform to fight a war directly against enemy forces within the air-to-air (that is, aircraft versus aircraft) or air-to-ground (that is, aircraft versus ground forces) combat arenas or that provide air transport (that is, airlift) support to friendly ground forces in the battle area. Fixed-wing tactical aircraft include fighters such as the F-14 or F-15 which are designed primarily for air-to-air combat; multirole aircraft such as the F-16 or F/A-18, which are designed for both air-to-air and air-to-ground combat; deep strike aircraft such as the F-15E or F-117, which is designed to penetrate behind enemy lines to attack ground targets; or close air support aircraft such as the A-10 or A/V-8B, which are designed to directly support friendly ground forces by attacking enemy armored vehicles, artillery, infantry, and supplies at the battle front. Helicopter (also called rotary-wing aircraft) gunships such as the AH-1 or AH-64 are flown in close air support roles similar to those of the A-10 or AV-8B. Airlift aircrews fly fixed-wing transport aircraft such as the C-130 or C-17 or helicopters such as the CH-53 or UH-60 to support ground forces.

The importance of aircrew training was recognized nearly from the beginning of military aviation. The first U.S. Army flying school was established at College Park, Maryland, in 1909. Within a year of America's entry into the first World War in 1917, ground schools had been set up at six leading universities and 35 new flying schools had been established to train aircrews for a rapidly expanding Army air arm (Boyne 1993). The United States also arranged for American aircrews to train through established French and Italian programs in Europe to speed the delivery of combat ready aircrews⁴ to the front. By the end of the war in November 1918, American air squadrons had reached the front and performed creditably in combat against veteran German aircrews. However, with the exception of eight bomber pilots, all of the American aircrews that participated in combat had completed at least some of their training in Europe. The task of establishing the needed flying training program from an almost nonexistent base proved to be too time consuming to get the 10,000 pilots trained in the United States into the battle prior to the Armistice being signed on 11 November 1918 (Boyne 1993).

America disarmed dramatically following World War I. Eighteen years later, just three years before the United States entered World War II, the Army Air Corps fleet included no more than 800 operational aircraft, most of which were obsolete by the prevailing world standards. Fortunately, however, the Air Corps had not forgotten the difficulties of preparing crews to fight in World War I and a plan had evolved during the intervening years that, among other aims, took steps to preserve the aircrew training base in order to be ready for rapid expansion. As a result, the Air Corps was able to expand its training program from a qualification rate of about 750 new pilots per year in 1938 to a rate that met the projected wartime demand for 100,000 annually (Boyne 1993). A critical step in the expansion program was the creation of hundreds of new military airfields to train student aircrews how to fly and the creation of aerial gunnery and bombing ranges to teach them how to fight. In Arizona alone, 22 military training airfields and 3 aerial bombing and gunnery ranges were established from 1940-1943 (Figure 1-1). The first 1.1 million acres of the Gila Bend Gunnery Range, which was later renamed as the BMGR, were withdrawn and reserved for use as an aerial gunnery and bombing range in 1941.⁵ The last addition to the range during World War II was completed in March 1943, which expanded the training area to 2,777,628 acres (4,340 square miles).

At the close of World War II, the United States repeated much of the pattern of unilateral demobilization that it had followed after World War I. The Army Air Force had a personnel

⁴ Combat ready aircrews are those that have successfully completed the training required to qualify as ready to fly a specific aircraft type in an operational unit. Operational units are the fighter, attack, bomber, airlift, and aerial refueling squadrons that form the nation's front-line air forces that could be committed to combat or potential combat situations at any time.

⁵ The first 1,077,500 acres of the range were withdrawn by Executive Order 8892 signed by President Franklin D. Roosevelt on 5 September 1941. Subsequent land withdrawals executed by executive order (signed by the President) or public land order (signed by the Secretary of the Interior or Agriculture as authorized by executive order) followed in succession until the BMGR reached its full World War II dimensions of 2,777,628 acres on 16 March 1943. This acreage represents the sum of the acreages in the four executive and two public land orders that were applicable to the range during the 1941-1945 period. The boundaries of the World War II era range formed a fairly close approximation of the current BMGR, which encompasses 2,668,100 acres.

strength of 2,253,000 and an inventory of about 70,000 aircraft at the close of World War II. A little more than one year later, the aircraft inventory had fallen to 24,000 of which only about

FIGURE 1-1
WORLD WAR II MILITARY FLIGHT
TRAINING IN ARIZONA
82 x 11 B&W

4,300 were operational. When the Army Air Force was reestablished as the U.S. Air Force⁶ in 1947, the personnel strength was down to about 300,000 (Boyne 1993). In 1946, military ranges and airfields throughout the country were deactivated, including what is now the BMGR and all of the Army airfields in Arizona except Williams and Davis-Monthan. The outbreak of the Korean War and the growing press of the Cold War, however, prompted the reactivation of the gunnery range, Luke AFB (formerly Luke Field), and Vincent AFB⁷ (formerly Yuma Army Airfield) in early 1951 (Keane et al. 1997).

Reactivation of the range and these air bases were significant events for preserving the national training base to meet the challenges of the Korean, Vietnam, Cold, and Persian Gulf wars as well as those of many smaller confrontations and contingencies. Without this reactivation, authorization for the BMGR would have expired in 1952 and jurisdiction for the range lands would have reverted to the Bureau of Land Management (BLM), U.S. Fish and Wildlife Service (USFWS), state, and private ownership (University of Arizona 1986). The Korean War brought a renewed training mission to the range, which reopened air bases and sparked reactivation of the range. These facilities have been indispensable for national defense training ever since.

1.3 DECISION TO BE MADE

As summarized in the introduction, the decision to be made by Congress is whether to renew the land withdrawal⁸ and reservation⁹ for the BMGR or allow authorization for the range to expire. The Secretary of the Air Force has identified a continuing military need for the BMGR and has prepared this LEIS as one of the required components in the application to Congress to renew the land withdrawal. One mechanism Congress has available to renew the range is the passage of a new public law. That new act would allow Congress, based on joint recommendations of the Air Force through the BLM, to define the size, duration, and terms of the BMGR land withdrawal to support the projected need for the military reservation. The Air Force has proposed redefining some of these terms as described in Chapter 2 of this draft LEIS. Alternatively, Congress could

⁶ 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.

⁷ First reactivated as Yuma Air Base but redesignated as Vincent AFB in 1956. Vincent AFB became Marine Corps Auxiliary Air Station, Vincent Field, Yuma in 1959 and was upgraded to Marine Corps Air Station (MCAS) Yuma in 1962.

⁸ “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.

⁹ “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.

extend the duration of the BMGR land withdrawal by passing a resolution to continue the land withdrawal and reservation terms of P.L. 99-606.

Non-renewal of the BMGR would occur if Congress elects to allow the land withdrawal to expire as specified in P.L. 99-606. In this event, the deactivation of the BMGR would likely require a period of several years in order to identify training missions to be retained, moved, or cancelled; relocate training missions performed on the range that are to be moved to other military installations; remove aerial bombing and gunnery targets and other range infrastructure; clean-up and restore target sites and other use areas as necessary; and decontaminate the range to eliminate unexploded live ordnance, and toxic and hazardous materials. There would likely be a need to use the BMGR to support some continuing flying training mission during this time period until those missions were cancelled or moved to other training facilities.

As directed by P.L. 99-606, Sec. 7(a), the Air Force and Marine Corps have maintained decontamination programs in and around designated target areas within the BMGR to achieve at least the level of cleanup of expended munitions accomplished in Fiscal Year 1986, when the current range withdrawal was enacted. These cleanup programs prevent an excessive accumulation of expended munitions from building up on the range surface and keep target areas in a serviceable condition. These ongoing programs are not intended or required to achieve complete decontamination of munitions, however, and unrecovered expended ordnance may be found on or below the range ground surface.

In the event Congress determines the BMGR land withdrawal shall expire, P.L. 99-606, Sec. 8(e) provides that the Secretary of the Interior may decline jurisdiction over former range lands that are contaminated to an extent that prevents opening such contaminated lands to operation of the public land laws. In this event, the Secretary of the Air Force is directed to take appropriate steps to warn the public of the extent of contamination on such lands and the risks associated with entering these lands. The Air Force would be unable to conduct any activities on the affected lands except those in connection with continuing decontamination efforts. With expiration of the BMGR withdrawal, some former range lands that are not found to be unacceptably contaminated would potentially be subject to entry under the public land laws (including the mining, mineral leasing, and geothermal leasing laws). The lands may be subject to new types of appropriative or non-appropriative land use; however, no new use could proceed until resource management planning is completed by the Department of the Interior (DOI) BLM.

1.4 PURPOSE OF AND NEED FOR RENEWING THE BMGR

The fundamental purpose of renewing the BMGR is to preserve a component of the national defense training base that is indispensable to the continued and future readiness of America's air forces to defend the security of the nation and its interests. Air warfare history demonstrates that (1) the performance of an air force as a deterrent to war or in actual combat is directly related to the quality and depth of training received by its aircrews, and (2) an air force must continuously reassess and update the character of its training if its aircrews are to succeed within the constantly changing air combat arena. The BMGR provides the center point to the vital aircrew training environment in southern Arizona and California that continues to ensure quality in-depth training at the student, operational, and command levels. The flexibility this range offers would keep it at the forefront as an up-to-date training facility for the foreseeable future.

American aircrews have generally been well prepared to meet the enemy in the air and support friendly ground forces whenever the need has arisen. To borrow a phrase from former Air Force Chief of Staff General Fogleman, America's success in aerial warfare *did not happen just by luck*. It happened because American aircrews were well trained to effectively use the competitive aircraft and weapons systems with which they were equipped to meet and defeat enemy air and ground forces.

1.4.1 Lessons from History—the Necessity of Aircrew Training

“Train like you will fight, fight like you trained.” This warrior's maxim has become the creed of American aircrews after repeated lessons from history have shown it to be the best path to success and survival in air combat. Lessons learned from U.S. air combat include the following highlights:

- # In World War II, the eventual American air supremacy over German and Japanese air forces made successful land invasions possible and saved countless thousands of U.S. ground troops, despite high initial losses of aircrews in 1941 and 1942. The ability of the United States to provide its aircrews with superior training at the newly established Gila Bend Gunnery Range (renamed the BMGR in 1986) and elsewhere became one of the key margins for achieving air supremacy.
- # In the Korean War, superior training led to a U.S. Air Force success ratio of 10 enemy aircraft downed for every one U.S. aircraft lost. American dominance in the air and in air-to-ground attack made it possible for United Nations ground forces to recover twice from devastating enemy offensives. Air power eventually helped to force the North Koreans and Chinese to accept an armistice ending the war.
- # In the Vietnam War, the initial air-to-air success ratio for the U.S. Air Force was only 2 to 1; but, through improved training, this ratio increased to 3.5 to 1. Through even more intensive training, U.S. Navy fliers achieved a 13 to 1 success ratio during a resurgence

of North Vietnamese air activity in 1972. America's success in the air war kept its ground forces free from air attack.

- # During the Cold War, well-trained aircrews were a primary deterrent in helping to prevent World War III. U.S. air power continues its current deterrent role today in the Korean peninsula, in the Middle East, and in the Balkans.
- # In the Persian Gulf War, well-trained U.S. aircrews lost no aircraft to air-to-air engagements and very few to surface-to-air fire. Just as important, the prowess of American aircrews in air-to-ground attack disrupted Iraq's communications and command systems, isolated its ground forces from resupply and reinforcement, and destroyed much of its war-making potential before it could be used.

In each of these wars and during the Cold War, the BMGR played a key role by allowing pilots to hone both air-to-air and air-to-ground combat tactics. The flexibility of the range to accommodate evolving air warfare tactics and technology has kept it at the front as a world class training installation. How lessons from history demonstrate a continuing need for such outstanding training facilities is further examined in the following subsections.

World War II

Upon entering World War II, America faced two principal adversaries with highly trained, professional air arms flying modern combat aircraft. Although superior in many ways to the American army and naval air forces that they faced as the war opened, the German and Japanese air forces would ultimately be defeated in large part because they failed to develop training programs that could produce the hundreds of thousands of qualified aircrews needed to fight a prolonged global war. In contrast, by 1940 the United States had already begun a training expansion program that would include the construction of hundreds of air bases and many gunnery and bombing ranges, including the future BMGR (see Section 1.2). The nation was fortunate to have the land and airspace resources available for these installations. As a result of the training expansion program, beginning in late 1942, America was able to field the large numbers of well prepared aircrews needed to contest, then reverse, the conquests of the Axis powers.

Remaining among the ranks of German and Japanese aircrews in late 1942 were large cadres of highly skilled veterans but their numbers were steadily dwindling. American replacement aircrews at this point were proving to be better prepared for combat than their Axis replacement counterparts. As the long air campaigns of 1943 and 1944 unfolded and Allied aircrews gained experience, their superior training was found to be one of the margins that gradually led to air supremacy.

American success in the air in World War II did not come without cost or setbacks. The air power victory cost 120,000 American aircrew casualties (Boyne 1993). High prices would also

be paid by American aircrews during the Korean and Vietnam wars. These sacrifices, though difficult to bear, must be viewed in balance with the progress made and lives saved in the underlying land battles. The invasions of and battles for Western Europe and vital Pacific island chains would not have been possible without the victories in the air war. Not only did U.S. ground troops come to know freedom from air attack, their cause was markedly and in many cases decisively advanced by American air attacks on enemy land forces, supplies, communications, and command and control structures.

Three important interrelated lessons emerged from World War II and remain valid in support of the proposed renewal of the BMGR. First, the war demonstrated that military land and sea power could no longer be exercised effectively without correspondingly strong air power. Second, air power held the promise to be a dominant or even decisive military force, particularly as its technology advanced. Third, air power success is dependent on the quality of training received by its aircrews and support personnel.

The Korean War

The Korean War experience provides two clear examples of the importance of aircrew training. First, during the opening phase of the war in 1950, American air power was desperately needed to disrupt the surprise North Korean invasion, which seriously threatened to overwhelm the retreating South Korean American-led United Nations ground forces. The needed air strikes were flown principally by American aircrews flying a collection of obsolete World War II fighters, bombers, and attack aircraft and some early vintage jet fighters. Led by a cadre of highly trained World War II veterans, this force disrupted the North Korean advance sufficiently to allow the land and sea forces needed to repel the invaders to be mustered. The air strikes succeeded because of the skill of the aircrews and the lack of a credible enemy air-to-air challenge.

American air power was called upon again a few months later to help blunt a second surprise attack, this time led by massive numbers of communist Chinese land forces that had entered the war on the side of the North Koreans. The Chinese Army, however, was supported by an air force that was well equipped with large numbers of frontline fighters. The Chinese Air Force quickly threatened to bring the indispensable American air strikes on enemy ground forces to a halt. In response, American fighter interceptor units were deployed to Korea. Opposing American and Chinese aircrews aircraft soon found that they were evenly matched, but Chinese fighter units were present in far greater numbers than the Americans. The intensity of the resulting air war rose and fell several times over the next two years, but in the end the outnumbered American aircrews had destroyed ten enemy aircraft for every one of their own lost. This decisive victory was achieved because of the superior training and skills of the American aircrews. As a result of this air superiority, enemy ground forces continued to be subject to air strikes and the American-led United Nations forces were not.

The Vietnam War

During the 15 years between the Korean War and the beginning of intensive U.S. Air Force involvement in the Vietnam War, significant technological advancements were made in aircraft and aircraft weapons systems. With these advancements came a change in thinking about the future of air-to-air combat. The advent of air-to-air missiles in the 1950s led aircraft designers and warfare planners to incorrectly forecast that guns would no longer be needed on aircraft to be used to destroy enemy aircraft. As a consequence, the early models of the F-4 “Phantom II” aircraft—which was destined to become one of the most important and widely used fighter aircraft developed since World War II—were built without guns, and aircrew training in close-in air-to-air combat tactics was de-emphasized.

Flaws in the above assumptions were quickly exposed in the skies over Vietnam. During the 1967-1968 period of the war, the U.S. Air Force air-to-air victory ratio over the North Vietnamese was only two enemy aircraft destroyed for every one U.S. aircraft lost. A long way from the 10 to 1 victory ratio the Air Force achieved in the Korean War. The Air Force responses to this loss rate were to install guns on the F-4 fleet and begin more rigorous training in air-to-air combat. Training at the BMGR—where aircrews at the time were being taught to fly the F-4, F-100, and F-104 aircraft—was upgraded to meet this need. The result was a victory ratio that climbed to 3.5 to 1.

The Navy, which had also endured unacceptable air-to-air results early in the Vietnam War, adopted an even more aggressive response by creating a new training program that focused a great deal of attention on air-to-air combat training that was as realistic as possible. As a result of the new program, later known as Top Gun, a 13 to 1 victory ratio against enemy air forces over Vietnam was achieved by Navy fliers in 1972. For more than three decades, the Top Gun program made frequent use of the airspace and electronic training support instrumentation located in the western side of the BMGR¹⁰. The Air Force also established an advanced combat exercise program at NAFR, dubbed “Red Flag,” which accurately simulated combat conditions. This program incorporates the use of the F-5 as an “aggressor” aircraft employing enemy tactics.

Aircraft, weapons systems, and air combat tactics have evolved rapidly throughout the history of aerial warfare. The experience with the F-4 “Phantom II” and air-to-air combat in Vietnam demonstrates why realistic training is critical for keeping pace with this evolution as well as for exposing the realities of forecasts about its consequences for air combat. Engineers and test pilots team to develop aircraft that are capable of meeting specified objectives, but ultimately aircrews must complete the marriage of aircraft, weapons, and tactics to form a force that is combat ready. This union can only be consummated in the air in a training environment where aircrews are challenged by conditions and tactical situations that are as realistic as the need for safety can tolerate. Combat ready aircrews are also the ones that will first develop new tactics to

¹⁰ The Top Gun program was moved from Naval Air Station (NAS) Miramar in southern California to NAS Fallon in Nevada in 1995.

counter emerging changes in an adversary's aircraft, aircraft weapons, air defense systems¹¹, or identify deficiencies in their own aircraft or tactics. The extent to which these discoveries can be wrung out in training rather than actual battle pays great dividends in terms of lives saved and combat effectiveness.

The need for high-quality, realistic training is further reinforced by another lesson relearned in Vietnam. As noted in the previous discussion on air-to-air victory ratios, the Air Force and Navy found that ordinary flight and gunnery training under conditions that did not accurately simulate combat was not effectively preparing aircrews for actual warfare. They also found that the informal "ten-mission axiom" from previous wars held true in Vietnam as well. That axiom states that if a combat aircrew survives their first 10 missions, then they will likely survive to complete their assigned combat tour. The 10 mission statistic indicated that an aircrew gained a "combat sense" over the course of those missions that improved either the speed or quality of their decision making, thus making them both less vulnerable and more effective in engaging the enemy. Post-combat reviews also found that most of the aircrews lost during their initial missions experienced hesitancy or confusion in their first contact with the enemy or had not yet acquired the necessary tactical agility to manage the unfolding battle situation.

The Air Force, Navy, and Marine Corps embarked on training programs following the war designed to make peace-time training as realistic as possible so that when aircrews "fought like they trained" they would find that training would reduce the 10 mission rule from the beginning. Training syllabuses were thus revised to focus the finite amount of training flight time available for student and operational aircrews on the essential requirements of actual combat. As one of the Nation's principal training ranges, the BMGR has been the scene of much of the success gained from realistic training.

The Cold War

American air power played a critical deterrent role during the Cold War in preventing a third world war and regional conflicts. American air power continues to help deter aggression in places such as the Korean peninsula and southwest Asia. As a part of the North Atlantic Treaty Organization (NATO), American air units were an essential counter to a significant numerical advantage in ground troops and combat equipment held by the Warsaw Pact nations. The quality of the American aircrews flying Cold War missions comprised a large measure of the deterrent effectiveness of NATO. The sacrifices of American aircrews lost in combat and in accidents when in training or on alert must be balanced against all the lives of civilians and military personnel that would have been lost had the deterrence maintained during the Cold War been ineffective.

¹¹ Air defense systems typically include surface-to-air missiles or anti-aircraft artillery and radars or infra-red heat detection systems that are used to track aircraft and control missile or artillery fire directed at them. Complex systems may include many batteries of missiles and artillery with different capabilities to intercept aircraft at various altitudes, distances, and speeds. These so-called "layered" systems are directed by a central command and control section to coordinate the defensive effort to achieve the greatest effect.

The Persian Gulf War

The validity of the emphasis the United States has placed on training since the Vietnam War was verified during the Persian Gulf War in 1991. During the short but intense air campaign, the United States lost no aircraft to air-to-air engagements and very few to enemy surface-to-air fire. Notably 50 percent of the F-16, 100 percent of the F-15E, most of the other F-15, and 100 percent of the A-10 aircrews that fought in the Persian Gulf were trained on the BMGR as students. Most of the F/A-18 and AV-8B aircrews from the Navy and Marine Corps had also trained on the BMGR. The results from the Persian Gulf War signify that renewal of the BMGR is not just about aircraft, weapons, and defense capabilities, but is about people as well. It is about the lives of American service men and women who are asked to go in harm's way on behalf of their country, and who need the skills to both do their job well and survive.

By no means did the Persian Gulf War mark the end to the evolution of aerial warfare. Any military organization that allows its training standards to be dictated by the tactics solely of the last conflict fought will likely be woefully unprepared to meet the challenges of the next. The enduring lesson of the Persian Gulf War for training then is that aircrews will continue to need premium ranges such as the BMGR to thoroughly challenge themselves as well as the new aircraft, weapons, and tactics with which they will be expected to fight in order to be prepared for the rigors of the next war.

1.4.2 BMGR Training Assets

The need for training that realistically approximates the way tactical aircrews are required to fight in actual combat is an unquestionable lesson from the history of aerial warfare. 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 second largest military reservation¹², the range 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 into the foreseeable future. The purpose of renewing the BMGR is to keep its training capabilities available for supporting existing and future aircrew training needs. The key assets of the BMGR in regard to national defense training include its combination of size, training capabilities, training capacity, and extensive supporting air base structure. Those key assets include:

- # restricted land and airspace
- # extensive land and airspace size
- # nearby supporting air bases
- # electronic training instrumentation
- # nearby supporting military airspace

¹² The NAFR, which is about 13 percent larger than the BMGR, is the Nation's largest military range with a current land area of approximately 3,050,000 acres (4,765 square miles).

- # year-round flying weather
- # varied terrain

Restricted Range Land and Airspace Areas

From the perspective of military operations, the BMGR is composed of lands and overlying restricted airspace¹³ (Figure 1-2). BMGR lands are made available for military use by virtue of P.L. 99-606. As previously noted, this Act reserves the BMGR land withdrawal for (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 restricted airspace associated with the BMGR is designated by the FAA.

P.L. 99-606 grants the Air Force the authority to control land use and access within the BMGR to the extent necessary to support military activities. This authority is essential to support the basic functions of the withdrawn lands of the BMGR which are to:

- # provide lands that support the requirement for realistic training
- # provide adequate locations and land space to contain the potential hazardous effects of tactical aviation training including aerial gunnery, bombing, rocketry, missile firing, electronic warfare, tactical maneuvering, and air support; as well as the effects of armament and high hazard testing and other authorized defense related purposesXthe purposes for which the range was established
- # protect public safety by excluding nonpermitted, nonparticipating surface users from areas where hazardous military activities are occurring
- # protect the safety of participating military personnel by excluding nonparticipants
- # prevent nonparticipants and incompatible land uses from interrupting or interfering with military training and support activities

The basic function of the overlying restricted airspace is to exclude nonparticipating aircraft in order to protect the safety of aircrews and passengers in both participating and nonparticipating aircraft and to prevent interruption of military training activities. Restricted airspace and the underlying controlled access lands support the key military value of the BMGR. The range

¹³ Restricted airspace is designated by the Federal Aviation Administration (FAA) to denote defined 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 nonparticipating aircraft of the potential presence of such hazards. The FAA delegates control of restricted airspace to a responsible military agency. In the case of the BMGR, Luke AFB is the designated controlling agency for the restricted airspace areas known as R-2301E, R-2301W, R-2304, and R-2305. Luke AFB has in turn delegated control of R-2301W to the Marine Corps and Navy. MCAS Yuma serves as the scheduling agency for R-2301W.

houses a series of weapons subranges that are authorized for live-fire¹⁴ training in air-to-air, air-to-ground, and surface (ground)-to-air warfare.

Live-fire training is essential to the abilities of aircrews to survive and win in combat. Modern weapons systems and the extreme pace with which combat events unfold have made the air-ground battlefield so deadly that aircrews can no longer afford a moment's hesitation or expect a second chance. They must have mastered their own aircraft, weapons systems, teamwork, and tactics prior to an actual battle so that their first decisions are not only good decisions but are made immediately. The only margins for error come on behalf of the enemy's mistakes; a blessing on which no one should count. Accordingly, an aircrew's first experience with realistic combat conditions and live-fire training, including the use of fully armed munitions, must be in training rather than in battle.

Range Land and Airspace Size

The land area of the BMGR is 2,668,100 acres¹⁵ (4,169 square miles) making it the second largest military reservation in the country. The four overlying restricted airspace areas closely approximate the shape of the range land area (see Figure 1-2). These contiguous restricted areas cover a land area of 2,766,720 acres (4,323 square miles) and contain about 57,000 cubic miles of airspace.

The extensive land and airspace areas of the range are important for four reasons. First, the range is large enough to safely accommodate many independent but simultaneous operations, which permits cost- and time-effective flight training. As shown on Figure 1-2, simultaneous flight training may occur within any of:

- # six subranges with bull's-eye type targets that are used for basic training in air-to-ground bombing and gunnery or for simulated nuclear weapons delivery (four manned ranges and the Moving Sands and Cactus West ranges)

¹⁴ Live-fire training on the BMGR includes aircraft gunnery of towed aerial targets, aircraft strafing attacks on ground targets; aircraft bomb, rocket, and missile attacks on ground targets and surface-to-air missile firings at aerial target drones. Aircraft air-to-air missile firings at aerial target drones occurs infrequently at irregularly scheduled times. Nearly all munitions used on the BMGR have inert (nonexploding) warheads with the exception that they may carry a small (but still hazardous) spotting charge to produce a puff of smoke to reference the location of the hit. Some training using munitions with armed (exploding) warheads is necessary but is tightly limited to five specific targets.

¹⁵ P.L. 99-606, which is the current enabling authority for the BMGR, identifies the size of the range land area as 2,664,423 acres. The legal description of the BMGR, which was published by the BLM in the Federal Register on 23 April 1987, as required by Section 2(a) of P.L. 99-606, lists the range area as 2,668,100 acres (4,169 square miles), more or less, of public and private land. All private lands within the range have since been purchased by the Air Force (San Filipe 1997).

- # three large tactical subranges for advanced realistic air-to-ground training in fighter and attack aircraft (North, South, and East Tactical Ranges)
- # two low-altitude and two high-altitude air-to-air training subranges used for both air combat maneuvers and aerial gunnery (Air Force air-to-air high and low subranges and the Yuma Tactical Aircrew Combat Training System [TACTS] high and low subranges)

Flight training may also occur simultaneously at two developed BMGR auxiliary airfields: Gila Bend Air Force Auxiliary Field (AFAF) or Auxiliary Field 2 (AUX-2).

FIGURE 1-2
11 X 17 COLOR
(4 pages)

Figure 1-2 (page 2)

Figure 1-2 (page 3)

Figure 1-2 (page 4)

Second, the range and many of its individual subranges alone are large enough to support training at or near the full capability of existing and planned aircraft and weapons systems. This attribute will be increasingly important as new air-to-ground attack weapons that can be released from an aircraft 20, 30, or more nautical miles (NM)¹⁶ from the intended target are incorporated into the Nation's active weapons inventory. These so called "standoff" weapons fly to the target either as a glide bomb supported by small pop-out wings (such as the Joint Direct Attack Munition [JDAM]) or as a powered missile. Advanced targeting guidance systems make these new weapons highly accurate. While it has not been determined where training with such weapons might occur, the BMGR has the land and airspace capacity to accommodate release of inert practice versions or fully armed examples of these weapons from an aircraft long distances from designated targets within the tactical ranges. The standoff weapon would fly safely through restricted airspace and over controlled access lands until the impact on the selected target.

Third, the BMGR has the capacity to accommodate realistic training exercises involving complex battle scenarios involving large forces of friendly and adversary aircraft. The Marine Corps conducts an advanced training course—the Weapons Tactics Instructor (WTI) Course—twice annually on the BMGR. The range currently has the resources to effectively accommodate the course's final exercise, which can involve as many as 100 aircraft of many types in a full-scale exercise that accurately simulates combat conditions.

The fourth reason is a lesson from history as well as a forecast for the future. At this writing, the BMGR has been in use for 57 years. During this period, tactical aircraft have evolved from the propeller driven fighter of World War II to today's highly sophisticated front-line jets and helicopters with many times the flight and weapons capabilities. As a result of these technological advancements and a corresponding evolution in air combat tactics, target and airspace subranges on the BMGR have been periodically developed, relocated, or retired to support changing aircrew training needs. Some target relocations or retirements have also been necessary to alleviate aircraft overflight conflicts with land uses on properties adjacent to the range. Fortunately, the BMGR has had the air and land space necessary to accommodate these changes without compromising training capacity or quality.

The lesson from history is that a range with sufficient air and land space can meet evolving tactical aviation training requirements. The future forecast is for the technology and tactics of air warfare to continue to evolve, as indicated in the above description of standoff weapons. As the second largest range in the nation, the BMGR has the capacity to keep pace with the corresponding evolution in training requirements. Thus the range can continue to be a critical asset for ensuring national defense readiness.

Proximity to Supporting Military Air Bases

¹⁶ One nautical mile equals 1.15 statute miles or 1.85 kilometers.

A basic requirement of tactical aviation training is for military bases to be within reasonably close proximity to training ranges if the training effort is to yield results that are effective in terms of costs and combat ready aircrews. As much as any of its other attributes, this relationship delineates the increasingly unique significance of the BMGR as a national defense training asset and may be attributed in part to its proximity to military air bases.

The BMGR is currently within the unrefueled flight radius of fixed-wing¹⁷ tactical aircraft from two Air Force bases, one Air National Guard (ANG) base, two Army Airfields (AAFs), two MCASs, one NAS, one Naval air facility (NAF), and Navy aircraft carriers off the Pacific Coast (Figure 1-3 and Table 1-1). The range provides helicopter aircrew training capability for two Army National Guard (ARNG) bases/heliports and one MCAS heliport. There are also two managed auxiliary airfield/heliports (one is Air Force and one is Marine Corps) within the BMGR for forward field operations. Finally, two unmaintained World War II era auxiliary fields within the BMGR are still used for some forward helicopter rearming and refueling operations.

Co-location of military bases and ranges allows aircrews and aircraft to spend a larger proportion of the limited and expensive flight time available for training on productive activities rather than enroute to and from the range. Military bases are also essential to provide the enormous amount of academic, technical, materiel, command and control, and military and nonmilitary community support necessary to keep aircrews and aircraft flying.

As shown in Figure 1-3, 15 active military air bases and Navy aircraft carriers currently have ready access to the BMGR. Base closures affecting MCAS El Toro and MCAS Tustin will reduce the number of air bases in the BMGR region to 13 by fiscal year (FY) 1999.¹⁸

The position of the BMGR within the direct reach of at least 13 military air bases is fortunate. Each base can support only a limited number of aircraft and aircrews. Because of the extraordinary investment in land, airspace, and money required to develop and support both the flying and nonflying functions of an airbase, few, if any, are likely to be built from scratch in the future. The BMGR has the land, airspace, and facility requirements to support a training load that is high in tempo and quality. Without a sizable military base infrastructure within the operating radius of the BMGR, however, the ability to exploit the training capacity, flexibility, and diversity of the range would be diminished.

¹⁷ Fixed-wing aircraft have conventional airframes in which wings provide lift and support aircraft directional control surfaces, and engines provide thrust through a propeller or jet turbine. Rotary-wing aircraft are helicopters in which the engine driven rotary wing provides lift, thrust, and directional control.

¹⁸ Federal fiscal years are from 1 October through 30 September.

FIGURE 1-3
MILITARY AIR BASES, AIRSPACE, AND RANGES IN THE BMGR REGION
11 X 17 B&W

TABLE 1-1 MILITARY AIR BASES AND AUXILIARY AIRFIELDS WITHIN THE OPERATING REGION OF THE BMGR		
Military Air Base	Location	Remarks
Air Force		
# Luke AFB	Glendale, AZ	# Host Command for BMGR, Air Force 56th FW, 944th Air Force Reserve FW, all F-16 training for Air Force, regular BMGR user
# Davis-Monthan AFB	Tucson, AZ	# Air Force 355th Wing, host for all A-10/OA-10 training for Air Force, host for Air Force/ANG seasonal (or snowbird) training deployments to the BMGR, regular BMGR user
# Gila Bend AFAF	BMGR	# BMGR operations/maintenance, emergency aircraft recoveries, forward heliport for Army National Guard operations on BMGR
# Arizona ANG Base (Tucson International Airport)	Tucson, AZ	# ANG 162nd FW, all F-16 training for Air National Guard, regular BMGR user
Marine Corps		
# MCAS Yuma	Yuma, AZ	# Delegated command for western BMGR operations, Marine Aircraft Group-13, AV-8B operational squadrons, VMFT-401 reserve F-5 training/aggressor squadron, principal Marine Corps/Navy deployment site for BMGR operations, regular BMGR user
# MCAS Yuma, AUX-2	BMGR	# Forward airfield for AV-8B, C-130, and helicopter training operations
# MCAS El Toro	El Toro, CA	# To close by FY 1999, units to move to MCAS Miramar, regular BMGR user
# MCAS Miramar	San Diego, CA	# MCAS Miramar (airfield/heliport) 3rd Marine Aircraft Wing, regular BMGR user
# MCAS Tustin (heliport)	Tustin, CA	# To close by FY 1999, periodic BMGR user
# MCAS Camp Pendleton (heliport and airfield)	Camp Pendleton, CA	# Marine Corps helicopter units, periodic BMGR user
Navy		
# NAS North Island	San Diego, CA	# Homeport for Navy aircraft carriers and shore-based air wings, periodic BMGR user
# NAF El Centro	El Centro, CA	# Forward airfield for Navy/Marine Corps pilot training, periodic BMGR user
# Pacific Fleet Aircraft Carriers	Pacific Ocean	# Use BMGR periodically to maintain aircrew readiness
Army		
# Libby AAF, Fort Huachuca	Sierra Vista, AZ	# Forward/outlying AAF for National Guard airlift and fighter aircrew training, periodic BMGR user
# Laguna AAF, Yuma Proving Ground (YPG)	YPG, AZ	# Forward AAF, usually not a BMGR user
# Silverbell Heliport, Western ARNG Aviation Training Site (WAATS)	Marana, AZ	# Supports helicopter training for ARNG (WAATS) and an operational Arizona ARNG 258th Attack Helicopter Battalion, regular BMGR user
# Papago Heliport, Papago Military Reservation	Phoenix, AZ	# Arizona ARNG Base, usually not a BMGR user
Unmaintained BMGR AUX Fields		
# Stoval AUX Field	BMGR	# Used for helicopter forward arming and refueling, parachute cargo drop, forward airfield C-130 aircraft, and other training operations on a limited basis
# AUX-6 (helicopters only)	BMGR	# Used for selected Marine Corps and ARNG training operations

Electronic Training Support Instrumentation

The BMGR is equipped with two electronic instrumentation systems that can be used to observe, measure, record, and replay the simultaneous actions of aircraft participating in air-to-air training engagements. The Goldwater Range Measurement and Debriefing System (GRMDS) is operated by the Air Force within the eastern half of the range. The GRMDS can currently accommodate up to 8 aircraft at a time but is being upgraded to handle 36. The Yuma TACTS range is operated by the Marine Corps and Navy within the western half of the range. The TACTS can already handle 36 aircraft simultaneously. Both the GRMDS and TACTS can simulate air-to-air weapons use so that aircrews can measure the effects of their attempts to attack or evade adversary aircraft without firing actual weapons. The TACTS range is equipped with a series of threat emitters that electronically simulate enemy radars and surface-to-air missiles. The TACTS range is also able to electronically simulate and score aircraft air-to-ground weapons attacks on ground targets. No ordnance is used during these simulated air-to-ground attacks.

The types of challenges that the GRMDS and TACTS range provide cannot be achieved short of actual air combat. Considering the extreme pace and deadliness of modern air warfare, there are no longer any tolerances for on-the-job training. Aircrews must come prepared for the job. Beyond flying the aircraft, the most critical aircrew skill is the ability to perceive, understand, and react effectively to the air combat situation unfolding around them. Tactical aircrews reference this skill as “situational awareness”^Xa skill that must be developed and nurtured. GRMDS and TACTS range training is indispensable to this training requirement.

The GRMDS and TACTS observe and record the enormous amount of situational information. The systems then provide instructor and training aircrews the capability to critically, objectively, and comprehensively review their performances, much as a professional sports coach and team review a game film. The GRMDS and TACTS allow aircrews to determine what they are doing wrong, what they are doing right, and which information and actions are critical to survival and winning. The systems allow them to improve their situational awareness in ways that no other training method can.

Availability of Supporting Military Airspace

As impressive as the capacities of the BMGR to support tactical aviation training are, no one range could accommodate all of the varied training needs of the military units stationed within or temporarily deployed to the BMGR region. The advantage of the BMGR is its position as the operational centerpoint of a semicircular array of military air bases, airspace, and ranges that form a highly flexible training complex (Figure 1-4). This complex is capable of meeting a wide variety of the tactical aviation training needs of the Air Force, Marine Corps, Navy, Army, National Guard, and reserve forces.

FIGURE 1-4

MILITARY TRAINING AIRSPACE IN THE BMGR REGION
11 x 17

The BMGR is best suited for live-fire training with aviation weapons; individual aircrew skill development through GRMDS or TACTS range support; and large-scale, complex, force-on-force exercises requiring an air-ground battlefield environment and instrumented range support. Scheduling priorities on the BMGR are reserved for these training missions.

Additional military airspace outside of the BMGR supports training in military aircrew skills such as basic aircraft handling and maneuvers, low-altitude navigation and aircraft handling, aerial refueling, advanced aircraft handling, and air combat tactics and maneuvering. These additional airspace areas include military operations areas (MOAs)¹⁹, air traffic control assigned airspaces (ATCAAs),²⁰ and an alert area²¹. These airspace areas can be used to support the types of military training activities conducted here. BMGR operations are also supported by a system of military training routes (MTRs²²) and two low altitude tactical navigation (LATN²³) areas.

¹⁹ MOAs are blocks of special use airspace designated to separate/segregate certain military aviation activitiesXsuch as high-speed flight and abrupt aerobatic maneuversXfrom air traffic flying on the Instrument Flight Rules (IFR) (includes most scheduled airline flights), and to identify where these activities are conducted to Visual Flight Rules (VFR) traffic. No aviation weapons may be fired in a MOA.

²⁰ An ATCAA is a block of airspace with a floor normally at or above 18,000 feet above mean sea level (MSL), but it can be lower. ATCAAs are usually designated directly above a MOA in order to provide sufficient vertical airspace room for military training activities. Air Traffic Control (ATC) provides separation between civil aviation and military aircraft participating in operations within an active ATCAA.

²¹ An alert area is a block of special use airspace designated to alert all pilots of an area that may contain a high volume of aircrew training activities, or an unusual type of aerial activity. All activities within an alert area are conducted in accordance with Federal Aviation Regulations and all pilots are equally responsible for collision avoidance.

²² MTRs are routes established generally below 10,000 feet MSL for use by military aircraft to conduct low-altitude, navigation, and tactical training at airspeeds in excess of the 250 knot speed limit that is imposed on all traffic without a waiver to exceed the limit below 10,000 feet. Knot is a short-hand expression for nautical miles per hour, a measure of speed that is an international standard in aviation and seafaring. A speed of 250 knots equals 287.5 miles per hour. Supersonic airspeeds are not authorized on MTRs.

An MTR is made up of several route segments with each individual segment having a designated route width and vertical altitude block within which the aircraft using the route must remain. Additionally, there are two types of MTRs - VR routes (VFR MTRs) and IR routes (IFR MTRs). MTRs designated as VR routes require that all flights be conducted in accordance with visual flight rules except that flight visibility shall be five miles or more; and no flights will be conducted below a ceiling of less than 3,000 feet above ground level (AGL). IR routes are used for low-level instrument flight training although aircrews flying an IR route in visual meteorological conditions must maintain visual separation from other traffic.

²³ A LATN area is more of a mission definition rather than an airspace structure. LATN areas have defined lateral and altitude dimensions and are used as locations for training aircrews of relatively slow flying aircraftXsuch as A-10 ground attack fighters, C-130 transports, and helicoptersXin the skills and tactics of low-altitude ground reference navigation. No limitations are imposed on civilian aviation within a LATN and no special operating advantages are extended to military aircraft. LATN areas cannot be scheduled. All aircraft must operate according to the more restrictive VFR and the 250 knot airspeed limit. Because of the low speed limit, training in fighter aircraft, such as F-16, does not occur in LATN areas.

MTRs provide special corridors for high-speed, low-altitude training flights. Military aircrews use the MTRs leading to the BMGR to practice long distance, low-level approaches to the simulated battle areas found on the range. All but one of the MTRs leading to the range are VR routes that can be used for training in terrain following flight (see IR-218 on Figure 1-4). This tactic is used by aircrews to mask (or hide) their approach from enemy radars by following a route that places intervening high terrain between their aircraft and the radar transmitters.

The Dome and Sells MOAs are contiguous with the BMGR. These MOAs are periodically used as staging areas in which flights of multiple aircraft assemble and, if appropriate, loiter until their scheduled time to enter the BMGR airspace. The Sells MOA is also used as an extension of the BMGR airspace for some training missions as well as a training area independent from BMGR operations.

Year-round Flying Weather

The desert climate of southern Arizona almost always provides at least 360 days of visual flying weather per year. When the merits of the BMGR are reviewed, this attribute is often cited first. Favorable climate contributes importantly to the efficiency of aviation training in the BMGR region and benefits tactical aviation in at least five ways.

First, the dependably good flying weather supports a high tempo flight training schedule. This schedule in turn provides the capacity needed to accommodate the combined training requirements of the many BMGR users. Because of the good weather BMGR users can reliably plan and fly their missions in a cost effective manner.

Second, both student and veteran aircrews benefit from flying frequently enough to develop and retain the highly refined skills that their profession demands. Experience clearly shows that these skills are eroded quickly by inactivity.

Third, the climate supports important training deployment programs for active duty, reserve, and ANG flying units from areas of the country with severe winter weather. 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 suffer a marked erosion in their combat readiness through the winter months.

Fourth, the warm and dry climate means that many aircraft maintenance tasks can be performed outdoors on the parking apron. Aircraft can also be stored out of doors without suffering the deterioration or malfunctions caused by high humidity or cold. The result is a savings in aircraft ground handling time and hangar space costs.

Fifth, costs for maintaining BMGR roads and facilities are also kept relatively low by the slow growth of the indigenous desert vegetation, low humidity, and infrequency of rain or freezing temperatures.

Varied Terrain

The highly varied terrain of the BMGR is ideally suited to its use as a tactical aviation training range. The range is characterized by broad alluvial valleys punctuated by a series of sharp, rugged, mountain ranges that lie along roughly parallel lines. Mountain ranges typically rise 1,000 to 2,000 feet above the intervening valley plains. The effect is a landscape that provides diverse air-ground combat challenges for aircrews.

Simulated military targets, such as airfields or vehicle convoys, are typically located on the alluvial plains. 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 rangeXeach 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 diversity that BMGR managers have generated through the use of terrain in target development, aircrews find each training sortie to be fresh and instructional, not repetitious. The cumulative experience aircrews gain by facing the tactical diversity of the BMGR is essential for preparing them for combat.

1.4.3 Integrated Full Service Training

The full merit of the BMGR as a training asset is more than a sum of the above attributes. Its role must also be assessed within the context of the air power training needs of the Department of Defense (DoD). The BMGRXin conjunction with the military airfields, additional special use airspace, and MTRs within its operational regionXforms the equivalent of a full service tactical aviation training university. Each component of this university provides essential services and each is dependent on others to support individual training missions. The BMGR, however, is the cornerstone of this university without which the instructional values of the other elements could not be realized.

The air bases provide the administrative, academic, and community resources of the university as well as aircraft, aircraft maintenance, and other needed support. Aircrews training to fly new aircraft types as well as veteran crews in operational units begin training in the classroom. Among the academic topics studied intensively are aircraft systems, weapons systems, communications, emergency procedures, tactics, and mission planning. Flying for aircrews new to an aircraft type begins in the simulator where instruction on basic aircraft flight and handling characteristics, instrument flying, weapons systems use, and other topics can be imparted. Veteran aircrews use the simulator to keep their skills sharp and to familiarize themselves with new equipment, procedures, or targets. The real flying starts at the flight line and may initially be limited to the air base traffic patterns and local flying area. Training efforts here focus on developing and reinforcing good flying skills, safe procedures, and familiarization with the aircraft systems. Cross-country flights to the many other military bases in the BMGR region are used to add navigation and the diversity of operating out of different airfields to the training process.

To this point, all flying except that in the immediate air base traffic area is conducted in airspace fully shared with civil aviation. The training activities are limited to those that are compatible with this joint-use aviation environment. The next training move is to the MOAs and ATCAAs. The MOA/ATCAA combinations, which essentially form airspace classrooms, are used for training in aspects of military aviation that are truly apart from civil air transportation. Included are activities such as basic and advanced aerobatic maneuvers, basic air combat tactics, fighter intercepts, and aerial refueling.

If MOA/ATCAAs are classrooms in the tactical aviation university, then the BMGR represents an entire college. As already noted and as shown on Figure 1-2, the range is partitioned into an array of subranges that provide the resources needed for instruction in:

- # basic and advanced techniques for bombing and strafingXAir Force manned ranges (live fire with inert munitions) and Marine Corps Moving Sands and Cactus West complex (live fire with inert munitions)
- # applied and advanced air-to-ground attack tacticsXAir Force tactical ranges (live fire with inert or live munitions) and Marine Corps/Navy TACTS Range (simulated bomb drops)
- # basic and advanced air-to-air tacticsXAir Force GRMDS and Marine Corps/Navy TACTS Range
- # live-fire aerial gunneryXAir Force air-to-air firing range (live fire with inert munitions)
- # forward airfield helicopter operationsXAir Force Gila Bend AFAF, AUX-6, and Stoval Airfield and Marine Corps AUX-2
- # forward/outlying airfield fixed-wing aircraft operationsXAir Force Gila Bend AFAF, Stoval Airfield, and Marine Corps AUX-2

- # ground-based air defense, air control, and communicationsXAir Force Stoval Airfield and Marine Corps Cannon Air Defense Complex and ground support areas
- # large scale force-on-force operations integrating the air-ground battlefieldXentire range
- # small armsXMarine Corps rifle range

In short, the BMGR provides all of the facilities necessary to (1) instruct student aircrews in how to fully employ tactical aircraft as effective combat weapons; and (2) keep veteran aircrews on the forefront of combat technology, tactics, and skill. The range has the capacity to support full scale combat training exercises, such as the WTI course, involving large opposing aircraft forces as well as air defense units and combat support personnel. This gives air combat instructors and senior commanders the opportunities to assess complex tactical problems, plan offensive and defensive responses to enemy actions, test new tactical theories and innovations, assess the teamwork capabilities of units under their command, and experience the command and control realities of force-on-force combat.

1.4.4 Future Requirements for the BMGR

Renewal of the land withdrawal is needed to support future training that will be similar to that currently performed. The United States has made a major investment in the tactical aviation training environment of the BMGR region. This investment includes the BMGR lands, designated military airspace overlying the range and elsewhere in the region, developed range infrastructure (targets, access roads, electronic instrumentation, etc.), and military airbases (see Figure 1-4 and Table 1-2). The size of this investment is well signified by the numbers of aircraft used annually on the range. (The following figures are FY 1996/1997 data.)

The combination of Air Force, Air Force Reserve, ANG, and ARNG flying units assigned to bases in Arizona currently support a combined total of 585 or more aircraft that fly training missions on the BMGR. An additional 145 plus aircraft deploy to Davis-Monthan AFB annually under Operation Snowbird to train on the BMGR. Regular Marine Corps, Marine Corps Reserve, and Navy users of the BMGR employ 215 fixed-wing aircraft. Additionally, 286 Marine Corps helicopters based in the BMGR region use the range periodically. Another 600 to 700 Marine and Navy aircraft from units stationed throughout the country and at overseas bases use the BMGR annually. MCAS Yuma is the forward deployment base that supports this training. Another 200 plus aircraft that are deployed to regional bases other than Davis-Monthan AFB or MCAS Yuma or that fly off of Navy aircraft carriers also use the BMGR each year. Each year, the BMGR is used by 800 aircraft belonging to units that are regular BMGR users, and from 950 to 1,200 aircraft that are deployed from outside of the region. More than 72,000 training missions (or sorties) were flown within the BMGR in FY 1996 using these aircraft.

TABLE 1-2

REGULAR BMGR USERS (1996/1997 DATA)				
Unit	Service Branch	Military Base	Aircraft Type	Approximate No. of Aircraft
56th FW ^a	Air Force	Luke AFB	F-16	192
944th FW ^b	Air Force Reserve	Luke AFB	F-16	18
355th WG ^c	Air Force	Davis-Monthan AFB	A-10/OA-10	74
162nd FW ^d	Air National Guard	Air National Guard Base at Tucson International Airport	F-16	65
162nd FW ^e	Air National Guard	Snowbird Operations at Davis-Monthan AFB	F-16, A-10, others	145 plus
WAATS ^f	Army National Guard	Silverbell Army Heliport	AH-1, OH-58	57
1-258th AHB ^g	Army National Guard	Silverbell Army Heliport	AH-64, UH-60	34
MAG-13 ^h	Marine Corps	MCAS Yuma	AV-8B	80
VMFT-401 ⁱ	Marine Corps Reserve	MCAS Yuma	F-5	13
3rd MAW ^j	Marine Corps	MCAS El Toro/ Miramar/Camp Pendleton	F/A-18, CH-46, CH-53, AH-1	396
VFT-126 ^k	Navy	NAF El Centro	F/A-18	12
<p>a 56th Fighter Wing has 8 training squadrons, largest Air Force wing</p> <p>b 944th Fighter Wing has 1 operational squadron</p> <p>c 355th Wing has 2 training squadrons and 1 operational squadron</p> <p>d 162nd Fighter Wing has 3 training squadrons</p> <p>e 162nd Fighter Wing is the host command for Snowbird training deployments by Air Force, Air Force Reserve, and Air National Guard to BMGR</p> <p>f Western Army National Guard Aviation Training Site is a training unit</p> <p>g 1-258th Attack Helicopter Battalion is an operational unit</p> <p>h Marine Aircraft Group - 13 has 4 operational squadrons (number of aircraft shown are exclusive of 3rd MAW total)</p> <p>i Marine Fighter Training Squadron - 401</p> <p>j 3rd Marine Aircraft Wing includes 21 operational and 1 training squadron and MAG-13 at MCAS Yuma</p> <p>k Training detachment from Navy fighter training squadron 126 NAS Lemoore</p>				

Most of the aircraft types currently used on the range are expected to remain in service for the first one to two decades of the next century, and possibly longer for some types. Consequently, the demand for BMGR training support will continue and is expected to remain at about the same level as represented by the above figures showing aircraft and training sorties served. The types of training to be performed and the range infrastructure needed to support that training is also generally expected to remain close to current norms. Some reconfigurations of weapons impact areas or airspace within the BMGR may be needed to support training with stand-off weapons, but the range contains the necessary land area and overlying restricted airspace to accommodate this potential use.

The expansive land and airspace resources of the BMGR also make this range a certain candidate for supporting training in the advanced aircraft types that will eventually replace those in the current inventory. Four aircraft types of interest are currently in the development pipeline.

The F-22A “Raptor” is an Air Force air superiority fighter that is planned to replace the F-15C early in the second decade of the next century. The first production F-22s are currently

undergoing testing. The combined land and airspace of the BMGR may have the potential capacity to accommodate this aircraft, although it is not currently programmed to fly at the BMGR.

A second new aircraft currently undergoing flight test is the Navy's F-18E/F "Super Hornet," a much enhanced descendant of the F/A-18C. The F-18E/F is expected to replace Navy F-14s and Navy/Marine Corps F/A18s beginning in the first decade of the next century. Navy and Marine Corps training use of the F-18E/F on the BMGR is likely.

A third new aircraft currently undergoing flight test is the Marine Corps and Air Force V-22 "Osprey," a tiltrotor aircraft. The V-22 is expected to replace the Marine Corps CH-46E and Air Force CH-53D helicopters. Marine Corps and Air Force training use of the V-22 on the BMGR is likely.

The fourth aircraft, the Joint Strike Fighter, is still in the early stages of development. This aircraft is envisioned as the follow-on replacement for the Air Force F-16 and for the Marine Corps AV-8B and F/A-18 as well. The BMGR is considered to be the likely choice as a training range for Joint Strike Fighter aircrews.

1.4.5 Conclusion

Air warfare history demonstrates that (1) the performance of an air force in actual combat is directly related to the quality and depth of training received by its aircrews, and (2) an air force must continuously reassess and update the character of its training if its aircrews are to succeed within the constantly changing air combat arena. The BMGR provides the center point to the vital aircrew training environment in southern Arizona and California that continues to ensure quality in-depth training at the student, operational, and command levels. The flexibility this range offers could keep it at the forefront as an up-to-date training facility for the foreseeable future.

1.5 SCOPE OF THE ENVIRONMENTAL REVIEW

1.5.1 Legislative Environmental Impact Statement

This draft LEIS is an analysis of the potential environmental effects of renewing or not renewing the BMGR as a military training reservation. Renewal basically means that military activities on the range would continue for at least the duration of the renewal period. With range renewal, land and airspace uses that are not compatible with the military activities (such as mining, grazing, and civilian aircraft) would continue to be excluded from the range, principally for safety reasons. This draft LEIS describes the purpose of and need for renewal of the BMGR, alternative range renewal actions, the environment affected by the renewal actions, and the environmental effects of the renewal actions. The foreseeable future military use of the BMGR is long-term continuation of much of the same activities as currently occur. Consequently, this draft

LEIS addresses future military use on that basisXcontinuation of existing activities. Requirements for new military activities may emerge during the course of the withdrawal period. This draft LEIS does not, however, specifically forecast or assess such future military use. Documentation to meet the requirements of the National Environmental Policy Act (NEPA) or other environmental compliance regulations would be prepared as needed to assess the decision alternatives required to meet new proposed military actions on a withdrawn BMGR.

Management of the natural and cultural resources of the BMGR cuts across the responsibilities of many agencies including, the Air Force, Marine Corps, BLM (Phoenix and Yuma Field Offices), USFWS Cabeza Prieta National Wildlife Refuge (NWR) and Ecological Services offices, and Arizona Game and Fish Department (AGFD). Concerns from within government agencies and from non-governmental groups have been expressed over recent years about the management effectiveness of this multiple agency structure. These concerns resurfaced among the comments received during the public scoping period for the proposed BMGR renewal. Options for the administration and management of a renewed BMGR have consequently been addressed in this draft LEIS. The assessment of these options is limited to a comparative analysis of the differences between various interagency management structures. Detailed analysis of how various natural or cultural resource elements should be managed or the development of new resource management plans are not within the scope of this draft LEIS. Resource management plans may be more effectively prepared after the renewal decision and agency management roles have been determined. When future decisions requiring NEPA supporting documentation arise, they will be addressed, as appropriate.

The no-action alternative is to not renew the land withdrawal of the BMGR, which means that military operations on the range would cease and the prohibitions placed in effect by P.L. 99-606 on appropriations under the public land laws would expire. Expiration of these prohibitions would mean that appropriative land uses such as mining, mineral leasing, or livestock grazing could potentially be reintroduced to portions of the expired BMGR outside of the Cabeza Prieta NWR. Cessation of military operations would also mean that public access to former range properties, such as the tactical ranges that are now closed to public entry for safety reasons, could potentially be opened for a variety of uses. For the purposes of the remainder of the analysis, it is assumed such uses would be determined through the BLM's public planning process, although it is possible that Congress itself would make some of those decisions were it decided not to renew the land withdrawal. This draft LEIS addresses in general terms the appropriative and non-appropriative potentials that could develop if the BMGR is not renewed.

1.5.2 Study Region

The study region for this LEIS is defined as the BMGR and areas affected by the BMGR. The geographic extent of the study region varies, however, depending upon the resource being analyzed. For example, with regard to earth resources, analyses are largely limited to the geology, topography, and soils within the BMGR, and the cultural resources analyses are limited to the BMGR land area. Whereas, with regard to socioeconomics, analyses include the

economics and demographics of communities affected by installations that are somewhat reliant on the BMGR to support a significant component of their training activities because these communities would be affected by the no-action alternative to not renew the BMGR. Therefore, the geographic extent of socioeconomic analysis includes much of southern Arizona and California.

1.5.3 Level of Study Detail

This document describes:

- the BMGR's mission, function, history, use, associated airspace, administration, relationship to nearby installations, and natural and cultural resources
- the proposed action and alternatives for renewal or non-renewal of the range
- the affected environment
- the effects of implementing the proposed action or alternatives

1.5.4 Scoping Process and Comments

A Notice of Intent (NOI) to prepare a LEIS for the BMGR renewal was published in the *Federal Register* on 9 February 1996 (Volume 61, Number 28, pp. 4965-4966). The NOI contained a brief statement about the current BMGR land withdrawal and reservation; the purpose of the proposed renewal; the alternatives; and dates, times, and locations of public scoping meetings. A copy of the NOI is included in Appendix A.

In addition to the NOI, several methods were used to notify the public and other government agencies. This included press releases to newspapers, radio, and television stations; advertisements published in seven newspapers; newsletters mailed to more than 1,100 individuals; and eight public scoping meetings held in various communities near the BMGR or the military installations that use the BMGR. Ongoing coordination has occurred throughout the preparation of the draft LEIS with cooperating agencies and other agencies having responsibilities involving BMGR lands and airspace. Continuing coordination with agencies and the public has also occurred at BMGR Partners meetings, public open house meetings, and Keystone Dialogue meetings (a forum, separate from the LEIS, to discuss long-term range stewardship that generated ideas and themes that have been addressed in other venues). More details on the public participation process are included in Appendix F of this document.

Through the initial agency and public scoping process, more than 300 comments were received from about 100 individuals. Some individuals made only one statement for consideration, while others provided several comments. Comments were organized into nine general issue categories

and 38 sub-categories. These categories, sub-categories, and types of comments received are listed alphabetically in Table 1-3.

The category receiving the most comments, at 28 percent of all comments, was land use/management. Of all the sub-categories, the greatest number of comments received regarded the alternatives. Of the individuals who commented on the alternatives, 29 percent supported the renewal of the BMGR, 7 percent opposed the renewal of the BMGR, and the others did not indicate a preference for or against range renewal. Within the general category of adjacent airspace, the sub-categories of military use and noise received the next highest percentage of comments. More than half the comments regarding military use and noise were from members of the Tohono O'odham Nation (U.S. DoD, Luke AFB 1996).

1.5.5 Resource Categories to be Considered

The process of determining resource categories to be addressed in this LEIS considered the affected resources, the results of scoping, and regulatory requirements (see Section 1.6). Environmental elements to be considered include military land and airspace use, civilian land and airspace use, public utilities and ground transportation, noise, health and safety, cultural resources, socioeconomic resources, environmental justice, visual resources, recreation, hazardous substances, earth, water, air, and biological resources.

<p align="center">TABLE 1-3 CATEGORIES AND SUB-CATEGORIES OF COMMENTS RECEIVED DURING PUBLIC SCOPING</p>		
Category	Sub-Category	Types of Comments
Adjacent Airspace	Military Use	Pilots are not always complying with no-fly zones or altitude restrictions when flying over the Tohono O’odham Nation, Ajo, and the Cabeza Prieta NWR.
	Noise	Noise from air operations, such as sonic booms, may cause mental and/or physical damage and disruption to humans (especially children), domestic livestock, and wildlife. Noise effects would be lessened if military activities were limited to unpopulated areas.
	Non-military use	The civilian air corridor between Ajo and Gila Bend does not contain enough vertical airspace to allow for some civilian aircraft.
Biological Resources	Threatened and endangered species	Sonoran pronghorn, flat-tailed horned lizard, Sonoran desert tortoise, lesser long-nosed bat, peregrine falcon, cactus ferruginous pygmy owl, southwestern willow flycatcher, and bighorn sheep may all be negatively affected by the renewal of the BMGR. There is a need for increased research into the effects of military operations on these species.
	Vegetation	The existence of the BMGR and current management practices have prevented some ground disturbance from occurring; however, continued military operations on the BMGR should not be allowed to expand and cause further disturbance. Evaluate the impact of the proposed actions on the spread of exotic plants.
	Wildlife	Military operations on the BMGR may be negatively affecting wildlife by endangering wildlife or fragmenting habitats. Artificial water development projects on the BMGR were both opposed and supported. Continued access to the BMGR for wildlife research should be addressed in the LEIS.
Cultural Resources	Archaeological Resources	Archaeological and cultural resources on the BMGR may have been disconnected from O’odham families and clans. The BMGR contains many archaeological resources that should be preserved.
	Historical	Historical sites should be preserved and made available for public visitation.
	Native American concerns	Sacred and ceremonial sites on the BMGR have been disturbed or destroyed. Native American governments should be consulted with on a government-to-government basis.
Hazardous Materials	Ordnance	Unexploded ordnance near watering holes may pose a threat to wildlife.
	Other chemicals and hazards	The effects of hazardous substances and materials on the BMGR should be evaluated and included in the LEIS.
Land Use and Management	Bureau of Land Management	The BLM is not properly managing public use on the BMGR. Surface management responsibilities for BMGR lands lies more appropriately with the BLM or USFWS rather than the Air Force.
	Coordination with other agencies	Land management of the BMGR should be unified, better described, better organized, and coordinated among the agencies involved. The LEIS should be preceded by discussions on resource management. Agreements, effectiveness, and accomplishments should be examined with regard to all agencies, organizations, and the public.
Land Use and Management	Coordination with regional plans	Land management at the BMGR should be coordinated with other regional plans such as the Maricopa Association of Governments’ Desert

<p align="center">TABLE 1-3 CATEGORIES AND SUB-CATEGORIES OF COMMENTS RECEIVED DURING PUBLIC SCOPING</p>		
Category	Sub-Category	Types of Comments
(continued)		Spaces Plan.
	Current management support	The Air Force is managing the BMGR land well. If the BLM were to take over management of the BMGR lands, the environment may be subject to livestock grazing, unlimited public access, and mining.
	Domestic livestock resources	There are potential impacts to livestock from current operations. The establishment of the BMGR cut off grazing rights for some cattlemen. Efforts should be made to prevent trespass cattle from entering the BMGR in Areas A and B.
	Military operations	Operations at the BMGR should not involve North Atlantic Treaty Organization troops. The LEIS should include a discussion on the impacts of military ground activities on vegetation, soils, habitat, wildlife, recreation, and adjacent (or underlying) wilderness. The LEIS should address the impacts of creating new tracks in the desert that are used by the public for recreation and that become informal roads, and the possibility of road building by the military. Base Realignment and Closure (BRAC) may cause a concentration of military operations in the southwestern United States. Ground troops should receive more environmental training.
	Public access/recreation	The recreation opportunities on the BMGR are wonderful. The military should continue to allow public recreation at the BMGR. Motorbikes should be allowed/continue to be disallowed on the BMGR. Public access to the BMGR should be less restricted/more restricted/stay the same.
	Reclamation	The BMGR should be analyzed for current and future impacts and a plan should be developed for the mitigation of those impacts. All new projects on the BMGR should include a plan and a budget for clean up and reclamation.
	Special management areas	Consider gaining recognition for the BMGR as a United Nations Educational, Scientific, and Cultural Organization (UNESCO) Biosphere Preserve. The three Areas of Critical Environmental Concern (ACECs) on the range should be protected in all ways and perhaps new ACECs should be created.
	Transfer of ownership	The BMGR should be turned back to the Tohono O’odham Nation. There are lands in the range that are unnecessary for the military mission and should be returned to the public domain. State and private land in the BMGR should either be traded with other federal lands or purchased by the federal government.
	USFWS management	Management responsibility for the BMGR lies more appropriately with USFWS than it does with the Air Force.
Miscellaneous	Scoping	Public input in the scoping meetings may not make a difference to the Air Force or Congress.
Physical Resources	Air	Cumulative impacts of military operations at the BMGR on air quality should be addressed in the LEIS.
	Geology	Any information on BMGR mineral resources should be revealed in the LEIS.

TABLE 1-3 CATEGORIES AND SUB-CATEGORIES OF COMMENTS RECEIVED DURING PUBLIC SCOPING		
Category	Sub-Category	Types of Comments
	Surface and ground water	The BMGR renewal may have potential impacts on surface- and ground-water quality.
Scope of the LEIS	Actions	More than scoping meetings are required to ensure that the concerns of the Tohono O’odham Nation are taken into consideration.
	Choice of alternatives	Support for the proposed action and the no-action alternatives. An indefinite withdrawal may not be limiting enough. The proposed time frame for renewal is too long/not long enough.
	Clarification of alternatives	The term indefinite needs to be better defined.
	Range of alternatives	Alternatives A and B are too similar. Consider a wider range of options.
	Suggestions for alternatives	The BMGR renewal should be limited to land with use absolutely needed for training purposes. The no-action alternative may not be the true no-action alternative as required by NEPA.
Socioeconomic Resources	Economics	The economic impacts of discouraging public use of special use airspace must be examined at both the local and regional levels. Homes on the Tohono O’odham Nation could be damaged by sonic booms and owners may not be able to afford repairs. Evaluate the economic impact of prohibiting mining in the BMGR.
	Environmental justice	The disproportionate negative effects of the proposed action on minority communities, especially the Tohono O’odham Nation, must be taken into consideration in the LEIS. Economic development plans on the Tohono O’odham Nation could be affected by the proposed action.
	Health and safety	Plane crashes en route to the BMGR threaten the health and safety of not only the life of the pilot, but also the residents of communities that underlie the paths flown.
	Housing	The process for receiving compensation from the military for making repairs to homes that are damaged by sonic booms does not work effectively.
	Infrastructure	The locations of transportation systems that may be affected by the proposed action should be identified in the LEIS.
	Landowner rights	The effects of the BMGR renewal on private property rights, such as those of the Child’s family, should be addressed in the LEIS.
	Population	The impacts of increased population and increased recreational visitation should be addressed in the LEIS.

1.6 APPLICABLE REGULATORY REQUIREMENTS

The umbrella authority for the current BMGR land withdrawal as well as for proposed renewal of that withdrawal is the Engle Act of 1958 (P.L. 85-337, 43 United States Code [U.S.C.] 155 et seq.). The Engle Act requires an Act of Congress to withdraw more than 5,000 acres of public

land for any one project planned by DoD. The Act also specifies that all mineral rights remain under the jurisdiction of the Secretary of the Interior but provides that there be no disposition of or exploration for minerals in withdrawn lands if the Secretary of Defense determines that it would be inconsistent with the military use of the lands (U.S. DoD 1994).

As previously stated, the current land withdrawal for the BMGR was authorized by Congress with P.L. 99-606. Renewal of the withdrawal requires the preparation of a draft EIS and the submission of an application for the renewal to the Secretary of the Interior by no later than 6 November 1998.

The application for renewal must be prepared in accordance with the rules and procedures for land withdrawals (43 Code of Federal Regulations [CFR] Chapter II Part 2300). These regulations require that an application for land withdrawal contain at least the following 14 components:

1. name and address of applicant
2. statement of authority of official filing application
3. a copy of written consent if the lands are under the administration of any other agency other than the DOI
4. the type of withdrawal action that is being requested and whether the application is for a new withdrawal or an extension or modification of an existing withdrawal
5. specific location of area involved in the application and a detailed description of the exterior boundaries and exceptions, if any
6. an identification of overlapping withdrawals (such as the Cabeza Prieta NWR)
7. the public purpose for which the lands would be withdrawn (if for national security, a description of the proposed use of lands)
8. the extent to which the lands in the application are requested to be withheld from settlement, sale, or entry under the public land laws (including the mining laws)
9. the type of temporary land use that may be permitted during the period of segregation
10. an analysis and explanation of why a right-of-way or cooperative agreement would not be sufficient for proposed use
11. the duration of the withdrawal and a justification for this proposed duration
12. a statement as to whether any suitable alternative sites are available for the proposed use

13. a statement as to whether water will or will not be needed for the purposes of the proposed withdrawal
14. the location where records relating to the application can be reviewed by interested persons

The regulations also describe the Secretary of the Interior's authority to process federal land withdrawal applications and outline nine basic steps in the withdrawal process:

1. pre-application consultation
2. submission of a (renewal) application to DOI
3. DOI publication of a notice of the (renewal) application in the *Federal Register*
4. negotiations between the Air Force and DOI and preparation of investigations, studies, and analyses required to process the application
5. preparation of the DOI case file, including findings and recommendations
6. transmittal of the case file to the Director of BLM for review
7. transmittal of the case file to the Secretary of the Interior
8. transmittal of the proposed legislation, recommendations, and documentation from the Secretary of the Interior to Congress
9. Act of Congress

This draft LEIS was prepared in accordance with NEPA (42 U.S.C. 4321-4347, as amended), the Council on Environmental Quality (CEQ) regulations for implementing the procedural provisions of NEPA (40 CFR Parts 1500-1508), and the Air Force Environmental Impact Analysis Process (32 CFR Part 989, Air Force Instruction 32-7061).

Individual resources may be affected by other regulatory requirements. For example, biological resources on the BMGR are affected by the Endangered Species Act of 1973 (16 U.S.C. Section 1531 et seq., as amended) and cultural resources are affected by the Archaeological Resources Protection Act of 1979 (16 U.S.C. Section 470aa-47011). These resource-specific regulatory requirements are introduced in Chapter 3.0, as they are

applicable. Appendix B provides a list of federal statutes, regulations, and guidelines.

1.7 ORGANIZATION OF THIS LEIS

Chapter 1.0 has provided a description of the

purpose of and need for the action as well as other introductory background information. Chapter 2.0 describes the proposed action and alternatives, including the no-action alternative. The affected environment is addressed in Chapter 3.0. Chapter 4.0 reports the projected environmental effects of the BMGR renewal alternatives and management actions to mitigate the effects of these alternatives. Similarly, Chapter 5.0 reports the projected environmental effects of implementing sub-alternatives for military administration, withdrawal land area, and the administration of natural and cultural resource management. Chapter 6.0 addresses the cumulative effects of the alternatives when added to other past, present, or reasonably foreseeable future actions. The appendices include the notice of intent to prepare this draft LEIS; a list of relevant federal statutes, regulations, and guidelines; a chronology of military use on the BMGR; lists of species likely to occur on the BMGR; programmatic agreements for cultural resources; a list of document preparers; information about public and agency participation; a document distribution list; references used in the preparation of the draft LEIS; and an index.

CHAPTER 2.0 - DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

2.1 INTRODUCTION

As reviewed in Chapter 1.0, Congress established in P.L. 99-606 the (1) 15-year duration of the current BMGR land withdrawal, (2) option of the Secretary of the Air Force to request renewal of the land withdrawal to support continuing military needs beyond the initial 15-year withdrawal,

and (3) requirement for publishing a draft EIS concerning a proposed renewal of the range land withdrawal. A continuing military need for the BMGR has been identified and this draft LEIS meets the requirement for publishing a draft range renewal EIS. An application to renew the land withdrawal will be submitted to Congress.

This draft LEIS proposes primary and sub-alternatives (or scenarios as they are called in this draft LEIS) pertaining to the pending congressional decision of whether or not to renew the land withdrawal. The primary alternatives are a proposed action to renew the land withdrawal indefinitely, an alternative action to renew it for 25 years, and a no-action (or non-renewal) alternative. The Air Force identified these primary alternatives when the Notice of Intent to prepare this draft LEIS was published. In summary form, the three primary alternatives include the following:

- # The *proposed action* is to renew the land withdrawal and reservation of the BMGR for an indefinite time period until Congress, through consultation with the secretaries of the military department(s) concerned, determines that a continuing military need for the range does not exist. A periodic Congressional review (e.g., every 15 years) would formally assess the continuing military need for the range land, military accountability for range use and stewardship, environmental issues associated with military use of the range, and the status of permitted non-military land uses. Congress could adjust the terms and conditions of the withdrawal if

warranted by the findings of the review.

- # The *alternative action* is to reauthorize the land withdrawal and reservation of the BMGR for a period of 25 years. The military would have the option to request further renewal of the range if a continuing military need for the land withdrawal beyond the 25-year period is identified.
- # The *no-action alternative* would not renew the land withdrawal. The no-action alternative would be implemented if Congress allows the current authorization for the BMGR land withdrawal under P.L. 99-606 to expire without reauthorization. The range would be deactivated under this alternative and military use of the formerly withdrawn lands would no longer be authorized.

The sub-alternatives (or scenarios) would be relevant only if the BMGR land withdrawal is to be renewed. The scenarios pertain to (a) whether military administration of the range should be directed by one or two departments of the DoD, (b) the land area of the range, and (c) which agency or agencies should administer management of the natural and cultural resources of the range. The need for these scenarios arose as a result of input received from the public and cooperating agencies during scoping for the draft LEIS. The following review explains this need.

P.L. 99-606 addresses the administration, size, and management of resources on the range by providing that the Secretary of the Air Force would serve as the military administrator of the range, the range would

include 2,668,100 acres²⁴, and the Secretary of the Interior would manage the range lands. When the range renewal LEIS process was initiated, the Air Force did not anticipate a need to ask Congress to consider changes in these three conditions. The only difference between the terms of P.L. 99-606 and those initially proposed for the range renewal was the duration of the land withdrawal. From the beginning of the renewal process, the Air Force has proposed an indefinite withdrawal period, or alternatively a renewable 25-year term. The principal reason for this position is that the continuing military need for the range was found to extend into the foreseeable future, which exceeds the 15-year duration established by P.L. 99-606.

²⁴ As corrected in the legal description of the BMGR published in the Federal Register on 23 April 1987. See also note 15 regarding the acreage of the range.

A need for the draft LEIS to examine alternatives to the above three conditions was identified as an outcome of scoping for the draft LEIS, continuing public involvement processes, and consultations with cooperating agencies. The scenarios (or subalternatives) that resulted from these public processes and agency consultations present choices for: (a) once again assigning the Air Force as the sole military administrator of the BMGR, or geographically splitting this responsibility between the Air Force and Marine Corps; (b) renewing the withdrawal and reservation of the existing range land area or excluding selected parcels of land that lie outside of the range restricted airspace from the renewal; and (c) once again assigning the responsibility for land management solely to the DOI, reassigning that responsibility to the Air Force or the Air Force and Marine Corps, or mandating that DoD and DOI agencies work collaboratively to manage the range lands. The above scenarios would either reaffirm or alter existing administrative responsibilities of DoD and DOI agencies currently involved with BMGR lands. These scenarios would not alter the responsibilities of state or local agencies—such as the Arizona Game and Fish Department (AGFD), which has management authority for wildlife. Under each of the administrative and management scenarios examined in the draft LEIS, continued cooperation and collaboration among federal, state, and local agencies would be necessary for fostering effective management of the BMGR.

Again, the scenarios are relevant only to a renewed land withdrawal. In summary form, the renewal scenarios proposed in this draft LEIS include:

- # Renewal Scenario A1. Renew the BMGR as one military reservation administered by the Air Force (identical to P.L. 99-606).
- # Renewal Scenario A2. Renew the BMGR as two military reservations administered by the Air Force and Marine Corps (change from P.L. 99-606).
- # Renewal Scenario B1. Renew the BMGR by withdrawing the same land area as the existing reservation (identical to P.L. 99-606).
- # Renewal Scenario B2. Renew the BMGR by withdrawing a smaller land area than that of the existing reservation (change from P.L. 99-606).
- # Renewal Scenario C1. Manage the natural and cultural resources of a renewed BMGR by maintaining the agency responsibilities and interagency agreements in effect under P.L. 99-606 (identical to P.L. 99-606).
- # Renewal Scenario C2. Manage the natural and cultural resources of a renewed BMGR by redefining the responsibilities of DoD and DOI agencies. DoD agencies would assume responsibility for managing natural and cultural resources outside of the Cabeza Prieta NWR and the BLM would assume a management advisory role for these same lands (change from P.L. 99-606).

- # Renewal Scenario C3. Manage the natural and cultural resources of a renewed BMGR through a collaborative interagency framework (change from P.L. 99-606).

Should Congress decide to renew the BMGR land withdrawal and select the terms expressed by Scenarios A1, B1, and C1, the effect would be to continue the corresponding conditions of P.L. 99-606. Selecting any other mix of scenarios as components of a range renewal would be a change from the terms established by P.L. 99-606.

The proposed and alternative range renewal actions; the no-action alternative; and the renewal administration, land area and resource management scenarios are described in detail in this chapter. Also identified are (1) alternatives that were evaluated but eliminated from detailed consideration (see Section 2.8), (2) a summary of the comparative effects of all the alternatives and scenarios, and (3) ongoing management actions. Chapter 4.0 reports the probable environmental consequences of each of the renewal and non-renewal alternatives. Chapter 5.0 reports the probable environmental consequences of each of the scenarios.

2.2 PROPOSED ACTION

2.2.1 Duration of the Renewal

Under this alternative, Congress would extend the land withdrawn for the BMGR and reserve these lands for military use for an indefinite period of time. The withdrawal would remain in effect until Congress, through consultation with the secretaries of the military department(s) concerned, determined that there is no further military need for the withdrawn land. A periodic Congressional review would validate the continued military need for the withdrawn land, review environmental issues associated with previous and continued uses, and examine the effectiveness of the public interaction process.

The military need for realistic range environments to train military aircrews is projected for the foreseeable future, and the BMGR is essential to meet the national defense responsibilities of the DoD. An indefinite duration withdrawal would support safe, efficient aircrew training needed to utilize weapons systems⁴⁸ for their expected life and sustain the combat readiness of aircrews and support personnel in the future. Maintaining long-term access to the BMGR is crucial because its capabilities and capacities cannot be duplicated.

The conservation and management of natural and cultural resources of the BMGR could be best served by implementing long-term environmental programs that promote understanding, protection, and improvement of these resources. Resources required for a recurring renewal process could be better attributed to implementation of BMGR environmental and public interaction programs. Therefore, under this alternative the military service secretaries would

⁴⁸ An aircraft combined with its target acquisition equipment (e.g., radar, optical television tracking system, laser or infrared targeting system, gun sight) and weapons (guns, rockets, bombs, or missiles) are considered to be a weapons system.

periodically report (e.g., every 15 years) to Congress the results of range stewardship. This report, subject to public comment, would include:

- # validation of continued military need for the range
- # a summary of environmental/public involvement programs and results
- # projection of environmental programs for the next period
- # cooperative environmental enhancement activities with other agencies
- # government-to-government relations with American Indian tribal representatives
- # status of permitted nonmilitary land use

An indefinite withdrawal with scheduled Congressional review and military accountability rather than a recurring renewal process, would facilitate more effective planning for and management of resources used to support military activities, promote more effective management of natural and cultural resources, and public information programs.

2.2.2 BMGR Military Land Use

A principal effect of renewing the BMGR would be to continue the existing pattern of military land use regardless of the duration of the renewal or the terms of military administration, land area, or resource management administration for the range. The following review of how BMGR lands are currently used provides the reader with a forecast of how these lands would most likely be used if the range is renewed. New or modified military land uses that can be foreseen at this time are also described. The following description is applicable to the proposed and alternative actions as well as Scenarios A1, A2, B1, C1, C2, and C3. This land use forecast is not applicable to the no-action alternative or the range lands not proposed for renewal in Scenario B2.

The BMGR is required to support a wide diversity of tactical aviation training activities as well as selected ground training and training support operations. To satisfy these requirements, the range has been partitioned into a series of 12 subranges, 4 auxiliary airfields, and 39 designated training or support areas. The subranges include 10 live-fire ranges and 2 electronically instrumented air combat tactics (ACT) ranges (see Figure 1-2). The live-fire ranges include Manned Ranges 1, 2, 3, and 4; North, South, and East Tactical (TAC) ranges; the air-to-air firing range; and the Moving Sands and Cactus West target complexes. The two instrumented ACT ranges include the Air Force GRMDS and the Marine Corps TACTS range. The four auxiliary airfields are Gila Bend AFAF, AUX-6, and Stoval Airfield on the Air Force section, and AUX-2 on the Marine Corps section. The 39 ground-based training and/or support areas are all on the Marine Corps side. Included are the Cannon Air Defense Complex, rifle range, parachute drop zone, and 36 designated ground support areas used for troop deployments. AUX-6 and Stoval Airfield are also used periodically to support troop deployments.

Range subareas based on land uses are described in the following sections. The range subareas are shown and numbered in Figure 2-1. These land use subareas are often, but not always, equivalent in size or shape to the airspace operations subranges shown in Figure 1-2.

Military land use of the entire BMGR can be summarized as follows:

- # Only about 0.1 percent of the BMGR land area, or 3,819 acres (Areas 13, 18, and 20), has no direct or indirect military purpose.
- # 20.6 percent of the range land area, or 551,379 acres (Areas 2, 3, 4, 5, and 16), is presently located within or below regularly scheduled live-fire ranges. The actual primary impact area from ordnance use is about 4 percent of this area; the remaining land serves as a secondary safety buffer area to contain the impacts of misaimed or inadvertently released ordnance.
- # 72.7 percent of the range land area, or 1,939,413 acres (Areas 6, 7, 8, 14, and 15), is in locations that may receive unplanned and unintended ordnance impacts based on the current configuration of live-fire ranges.
- # Less than 0.1 percent of the range lands area, or 821 acres (Area 12), is within the State Route 85 right-of-way, which serves public and military transportation needs.
- # 2.4 percent of the range land area, or 64,614 acres (Areas 10, 11, 17, and 19), is outside of likely or potential weapons impact zones but does support a number of military facilities and functions and serves principally to control access, enhance public safety, and ensure compatible land use.
- # 41. percent of the range land area, or 108,310 acres (Areas 1 and 9) is outside of potential weapons impact zones and serves to control public access, enhance public safety, and ensure compatible land use.

The proposed renewal action would continue military use of the BMGR as generally described above. As previously noted in this draft LEIS, the placement of targets and the structure of subranges on the range have evolved gradually over time to keep pace with changing training needs. Appendix C provides a chronological review of these changes and other selected events from the history of the BMGR. Additional changes in the range infrastructure could be expected to occur during the proposed renewal period to meet emerging training needs. However, the general pattern of military land use within the BMGR, which has been fairly constant since the late 1960s, would not be expected to change notably in the foreseeable future. The advances in military technology and tactics that are emerging would not precipitate radical changes in range infrastructure to accommodate the training requirements which would accompany these advances. The existing pattern of military land use, which is described in the following sections, would continue to be the predominant pattern of military use well into the foreseeable proposed range withdrawal period. Documentation to meet the requirements of NEPA or other environmental compliance regulations would be prepared as needed to address new proposed military actions on a renewed BMGR.

Range Land Use Area 1 on Figure 2-1

Area Description. Includes all BMGR land northeast of the R-2304 airspace. Most of the area is designated as special Air Force Management Area A⁴⁹ for the purpose of controlling public recreation access.

Area Size. 131 square miles, 83,554 acres (All area calculations reported in this and the following land use subsections are based on a GIS analysis using the BMGR perimeter boundary as depicted by the Arizona State Land Department.)

⁴⁹ Management Area A is a special designation used by the Air Force in permitting access. Area A is discussed in Section 3.11 of this LEIS.

FIGURE 2-1
EXISTING MILITARY LAND USE ON THE BMGR
11 X 17 COLOR

Military Land Use Access and Encroachment Control. This area is managed to (1) prevent unauthorized surface access to East TAC Range and Manned Range 3, (2) alert surface users to the potential presence of hazardous unexploded ordnance, and (3) exclude surface uses that may not be compatible with noise effects from aircraft overflights and ordnance blasts.

East TAC Range and Manned Range 3 are high hazard ordnance impact areas that support live-fire training in the use of air-to-ground weapons (see Figure 1-2 for location of Manned Range 3). Unauthorized (and thus unscheduled) entry to these impact ranges would expose the trespassers to potentially lethal weapons training activities. The discovery of trespassers also causes costly interruptions in scheduled military use as all training must be aborted until the trespassers are removed or confirmation is obtained that they are otherwise clear of the weapons range.

Surface users may enter Area 1, as well as all other BMGR areas, by permit only. Permittees are (1) briefed as to the presence and dangers of East TAC and Manned Range 3; (2) given strict warnings to stay clear of these ranges; (3) provided with navigational guidance and maps; (4) required to check in and out of Area 1 on a predetermined schedule; and (5) required to sign an agreement acknowledging the dangers of the area, and releasing the U.S. government from any claims of harm due to these hazards.

The perimeter of the BMGR along the northern and eastern sides of Area 1 is fenced and posted with restricted entry warning signs wherever the terrain and roads may permit surface access. The effectiveness of Area 1 for deterring trespass within East TAC and Manned Range 3 is further bolstered by the printed warnings about the restricted and hazardous nature of the BMGR and/or the requirement for an entry permit on most maps used for public travel.

Air Force records from 1953 indicate that one simulated convoy target composed of old car or truck bodies may have been located in the southeast corner of Area 1. The target was authorized for strafing fire only. Expended gunnery munitions, rockets, and bombs can be located elsewhere within Area 1 along its border with East TAC range. The potential that live, unexploded, and still dangerous munitions may be present on or below the soil surface in this area cannot be discounted. To mitigate this potential hazard, Air Force management mandates that visitors entering this area and all other BMGR locations receive appropriate safety briefings and sign the required Hold Harmless Agreement.

Currently authorized non-military uses within Area 1 include natural and cultural resource conservation, dispersed recreation, and hunting. Inclusion of this area within the BMGR withdrawal precludes appropriate land uses such as livestock grazing, mining, or other economic developments. Noise effects occur in Area 1 from ordnance detonation and aircraft overflights in the nearby East TAC Range and Manned Range 3. Additional noise effects occur from low-flying aircraft either entering or leaving East TAC Range or loitering over Area 1 until cleared to enter East TAC. By precluding uses that are not compatible with East TAC Range and Manned Range 3, Area 1 protects the viability of these weapons ranges from external encroachment.

Range Land Use Area 2 on Figure 2-1

Area Description. Includes the East TAC Range land area.

Area Size. 177 square miles, 113,520 acres

Military Land Use ~~X~~*Air-to-Ground Tactical Weapons 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 ~~X~~HE Hill⁵⁰ and the live Maverick⁵¹ air-to-ground (missile) target ~~X~~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 constitute a fairly small portion 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 live-fire 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 live ordnance or inert ordnance with unfired signal cartridges. The vast majority of such contamination, however, is found in close proximity to targets.

Range Land Use Area 3 on Figure 2-1

Area Description. Includes the land area of North and South TAC ranges.

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

⁵⁰ 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.

⁵¹ 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 NM.

Military Land Use ~~X~~*Air-to-Ground Tactical Weapons 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. Each of these TAC ranges supports one HE Hill target. A single live Maverick target is located in North TAC Range near its common boundary with South TAC Range.

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 within close proximity of 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. Unexploded armed ordnance or inert ordnance with unfired signal cartridges could be found 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.

Range Land Use Area 4 on Figure 2-1

Area Description. Includes the potential munitions impact areas of Manned Ranges 1, 2, 3, and 4.

Area Size. 69 square miles, 44,384 acres

Military Land Use ~~X~~*Air-to-Ground, Manned Weapons Ranges.* Each of the four parcels associated with one of the four manned ranges contains the air-to-ground targets of the range and the surrounding area of land in which misaimed ordnance is likely to impact. Each manned range has (1) two bull's-eye targets for scorable training in conventional bombing and rocketry, (2) one bull's-eye target for scorable 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 unscorable conventional bombing or rocketry training, (4) one scorable target for training in low-angle strafe, and (5) one unscorable tactical strafe target for low-angle strafe. Manned ranges are restricted to inert training practice munitions only; thus, the surface danger zone does not have to account for blast effects.

Range Land Use Area 5 on Figure 2-1

Area Description. Includes the ordnance and target fall out area⁵² for the Primary Air-to-Air Gunnery Range.

Area Size. 158 square miles, 101,040 acres

⁵² A fall out 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.

Military Land Use X Primary Air-to-Air Gunnery Range. The designated lands serve as a fall out area for 20 millimeter (mm) munitions expended in the overlying Primary Air-to-Air Gunnery Range. Aerial Gunnery Target System ⁵³(AGTS) tow targets fall into this land area if the tow cable is severed from the tow aircraft or the targets must be jettisoned because of gunnery damage. Large numbers of expended Deployable Aerial Rigged Targets (or DARTs), which were previously used as aerial tow targets, are scattered within Area 5. The 12-foot-long DARTs were designed to simulate an airplane target.

Range Land Use Area 6 on Figure 2-1

Area Description. Includes the ordnance and target fall out area for the Alternate Air-to-Air Gunnery Range.

Area Size. 136 square miles, 86,914 acres

Military Land Use X Alternate Air-to-Air Gunnery Range. The lands underlying the Alternate Air-to-Air Gunnery Range are designated to serve as a fall out area for 20 mm munitions and AGTS targets in the same manner as those reserved for the primary range. The formerly used DARTs are also found scattered about Area 6. The alternate range overlies the Cabeza Prieta NWR, and was last used in 1994. Regular use of this range ended as a result of a reduced requirement for aerial gunnery training and an agreement with USFWS that the alternate gunnery range would not be activated with less than 60 days of written notice.

Range Land Use Area 7 on Figure 2-1

Area Description. Includes eastern section lands that underlie R-2301E, R-2304, and R-2305 airspace but are outside of the tactical, manned, and aerial gunnery ranges.

Area Size. 882 square miles, 564,215 acres

Military Land Use X Potential Ordnance/Aerial Target Impact, Low-Level Overflight, Range Maintenance and EOD Support, and Access Control Areas. The three TAC ranges, four manned ranges, and one aerial gunnery range are configured within the eastern section of the BMGR to support simultaneous training operations in all eight ranges. Each range is of a size and shape designed to contain the weapons training activities it is designated to support. In addition, each

⁵³ 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 12 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.

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 ranges in the eastern section leaves intervening lands which are managed to:

- # serve as access control areas that could safely contain rare and unplanned impacts from inadvertently released ordnance or aerial targets without undue risk to people or property
- # support routine, low-level overflights by excluding incompatible land uses
- # support ongoing target maintenance and EOD functions
- # provide positive access control to lands adjacent to live-fire ranges

The portion of Area 7 east of State Route 85 and south of the Saucedo Mountains is designated as Air Force Management Area B for the purpose of controlling recreation access to this area of the BMGR. Members of the public that obtain the required range entry permit are allowed to enter Area B for recreation activities. An approximately three-acre Air Force small arms range is located within Area 7, south of Area 10 and west of Area 12 (see Figure 1-2). Entry to the small arms range is restricted. Although currently unplanned and unforeseen, future reconfiguration of either the TAC or manned ranges could incorporate portions of Area 7 within new target impact areas.

Range Land Use Area 8 on Figure 2-1

Area Description. Includes the portion of the Cabeza Prieta NWR that lies within the BMGR, except for the land underlying the alternative air-to-air range (see Land Use Area 6).

Area Size. 1,139 square miles, 729,233 acres

Military Land UseXPotential Ordnance/Aerial Target Fall Out Area and Electronic Instrument Sites. Approximately 95 percent of the Cabeza Prieta NWR land area has served as a part of the BMGR since the World War II training era. Prior to 1960, intentional bombing and strafing of targets within the alluvial basins of the Cabeza Prieta NWR was authorized; however, such training practices diminished sharply after World War II. All of the refuge is overlain by restricted airspace from the surface to 80,000 feet MSL.

The refuge has also functioned since World War II as a fall out, or potential fall out, area for ordnance and targets used in air-to-air or surface-to-air combat training. By agreement with the USFWS, prearranged use of the refuge for aerial gunnery fall out is limited to the Alternate Air-to-air Gunnery Range with 60 days of prior notice.

The refuge R-2301W airspace could also be subject to impacts from expended surface-to-air or air-to-air missiles or aerial drone targets. Ten to 40 HAWK⁵⁴ surface-to-air missiles are fired by the Marine Corps on one weekend each year at remotely controlled drone targets. The missiles are launched to the east southeast from the complex of ground support areas south of Tacna, Arizona (see Figure 1-2), at drones orbiting above the eastern extent of Area 14 (see Figure 2-1). These missile firings occur as part of a required annual validation test of the HAWK system and provide the only live-fire training opportunity for Marine Corps air defense units that use this system. The missiles are fitted with a command destruct system so that rounds that miss the target can be destroyed within the designated test area that lies north of the Cabeza Prieta NWR. Portions of the refuge lie within the flight range of the HAWK missiles, however, and an errant round or debris from such a round could potentially impact within the refuge.

The surface of the refuge could also become important as a potential surface danger zone in the future for training with stand-off weapons, if the training is done at the BMGR. The stand-off weapons referred to here are air-to-ground munitions equipped with guidance and steering systems that can be released from an aircraft many miles from the intended target out of range of air defense weapons. Once released, stand-off weapons guide themselves to the target with a high level of accuracy. This class currently includes weapons such as the Maverick air-to-ground missile with a range of up to 13 NM. New weapons, such as the joint direct attack munition or JDAM⁵⁵, with much longer stand-off ranges are due to become operational within the next 5 to 10 years and potentially may be used in training exercises at the BMGR. As longer range stand-off weapons become operational, the need for training with such weapons may require aerial launch points above or within range of the Cabeza Prieta NWR. Although the prescribed target and probable weapon impact area would be outside of the Cabeza Prieta NWR, the potential secondary impact area for an errant round could include parts of the refuge.

Area 8, as shown on Figure 2-1, is incorporated within the BMGR to ensure that access to the Cabeza Prieta NWR can be restricted during periods when the area may be exposed to potential weapon impacts. Although such impacts are not intended and are unlikely, access must be restricted to protect public safety.

Five locations within the Cabeza Prieta NWR are used as sites for electronic instrumentation that supports air-to-air combat training. Four of these small instrument sites are part of the GRMDS operated by the Air Force and one is part of the TACTS operated by the Marine Corps. Both training systems measure and record the flight parameters and simulated weapons engagements of aircraft participating in air-to-air combat training. The instrument sites are placed on mountain peaks and ridges for effective line-of-sight radio and microwave communication and transfer of

⁵⁴ 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 which guides the weapon to the target.

⁵⁵ JDAM is a standard 1,000- or 2,000-pound bomb fitted with a special tail kit equipped with a Global Positioning System (GPS) guidance system and steerable tail fins. The kinetic energy imported to a JDAM released at a high airspeed and altitude of about 25,000 feet is sufficient to carry the bomb to a target as much as 20 NM away. The GPS guidance system will give the JDAM the ability to strike within 39 feet of the aimpoint. Deployment of JDAMs within the Nation's air forces is expected to begin as early as 2003.

the needed aircraft performance data. These data are processed for electronic replays and analysis of the training exercise.

In a policy dating from August 1951, as agreed upon by the Department of the Air Force and the Department of the Interior, routine military overflights of the Cabeza Prieta NWR (including Areas 6 and 8) are limited to altitudes of 1,500 feet AGL or higher. This policy has been reaffirmed in a series of four such agreements, the most recent of which was a November 1994 MOU. The 1994 MOU superseded a similar 1975 MOU which was specifically referenced and left in effect by P.L. 99-606. The restricted airspace over the refuge below 1,500 feet AGL is also used for military flights but only along low-level corridors mutually approved by the Air Force, Marine Corps, and USFWS as agreed in the 1994 MOU. The current provision for low-level overflights on mutually approved corridors dates from the 1975 MOU and is reaffirmed in the 1994 MOU.

Range Land Use Area 9 on Figure 2-1

Area Description. Includes BMGR lands north of Manned Range 4 that lie outside of the R-2301E airspace.

Area Size. 39 square miles, 24,756 acres

Military Land Use X Access and Encroachment Control. This remote and ordinarily unpatrolled area is currently managed by the Air Force to restrict public access to Manned Range 4 and North TAC Range, and to prevent the introduction of land uses that are not compatible with Manned Range 4 operations.

Current Air Force policy limits public access to Area 9 to periods when no military operations are scheduled because of the hazards present at both Manned Range 4 and North TAC Range. Existing roads lead from Area 9 into surface danger areas of Range 4 and North TAC Range. Public access to Area 9 must be carefully controlled to prevent inadvertent entry to these hazard areas.

Air Force management of Area 9 also excludes land uses, such as campgrounds or livestock grazing, that could place people or property in near proximity to a live-fire range. Such uses also may be incompatible with the aircraft and gunnery noise associated with Manned Range 4.

Range Land Use Area 10 on Figure 2-1

Area Description. Includes BMGR lands near AUX-6 that are west of State Route 85 and north of the R-2301E and R-2305 airspace areas. This area includes most of special Air Force Management Area C (see Section 3.11 for a description of Area C).

Area Size. 29 square miles, 18,651 acres

Military Land UseXAuxiliary Airfield Operations and Access and Encroachment Control. This area is managed to control public access to periods when AUX-6 is not in use. 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. Public visitation to the area is suspended during training operations to prevent interruption of the exercise and to protect the safety of civilians and military personnel.

Inclusion of Area 10 within the BMGR also precludes developments or land uses that are incompatible with the aviation and ground-based training activities performed at AUX-6.

Range Land Use Area 11 on Figure 2-1

Area Description. Includes Gila Bend AFAF and BMGR lands east of State Route 85 and north of the R-2305 airspace. This area includes most of special Air Force Management Area D (see Section 3.11 for a description of Area D).

Area Size. 10.5 square miles, 6,746 acres

Military Land UseXAuxiliary Airfield Operations, Aerial Tow Target Drop Zone, and Access and Encroachment Control. This area is managed to control public access to Gila Bend AFAF, the drop zone for jettisoned aerial tow targets (i.e., AGTS targets) and cables, Manned Range 3, 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 experience malfunctions 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 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 use Gila Bend AFAF as a forward operating area to support live-fire training within North and East TAC ranges. WAATS activities at Gila Bend AFAF include aircrew changes and helicopter refueling and rearming. A WAATS proposal to expand the existing munitions storage area at the auxiliary field from 650 square feet to 2,650 square feet to support expanded training requirements was approved on 31 July 1997 with the signing of a Record of Decision addressing this project and other WAATS expansion plans (National Guard Bureau 1997).

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, 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. An Air Installation Compatible Use Zone (AICUZ) study was recently completed for Gila Bend AFAF. The auxiliary field supported 19,650 fixed-wing aircraft operations and 3,270 helicopter operations in 1996 for a total of 22,920 operations.

The Range Operations Control Center (ROCC or Range Ops) for the Air Force side of the BMGR 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 the eastern land section. Additional information on ROCC operations and range access are available in the Final Public Health and Safety Technical Report (U.S. DOD, Luke AFB 1997).

Gila Bend AFAF also houses support facilities for the control, maintenance, and security of the BMGR and air traffic control, fire department, and flightline service for the airfield. The airfield hosts the BMGR Security Policy office and billeting for visiting personnel working temporarily on the BMGR.

The AGTS target drop zone is located 4,000 feet south of the approach end of runway 35. The jettison process includes the release of the AGTS target and tow cable. AGTS targets and cables are collected from the drop zone for recycling and disposal.

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

Range Land Use Area 12 on Figure 2-1

Area Description. Includes a 200-foot-wide easement through the BMGR for State Route 85, utility lines, and the Ajo to Gila Bend railroad.

Area Size. 1.3 square miles, 821 acres

Military Land Use Highway, Utility, and Railroad Easement. The purpose of the highway, utility, and railroad easement is to provide public transportation and utility services through the BMGR between Ajo and Gila Bend. The highway is used routinely by military personnel to reach AUX-6; Manned Ranges 1, 2, 3 and 4; and North, South, and East TAC ranges, but has no other military purpose.

Range Land Use Area 13 on Figure 2-1

Area Description. Includes BMGR lands east of State Route 85, south of the R-2305 airspace, and around the Ajo Airport.

Area Size. 4.3 square miles, 2,779 acres

Military Land Use ~~X~~*Ajo Airport and Country Club, No Military Purposes.* This area of the BMGR has no current military purpose. The Ajo Airport was a military airfield during World War II that was used to support range operations. Military use of the airfield ended shortly after the war. Conversion of the airfield to a civilian airport in 1946 included the deletion of the airport property from the range withdrawal. Area 13 is effectively isolated operationally from other BMGR lands by State Route 85. Because of its relatively small size, odd configuration, location, and probable conflicts with existing civilian uses, this area has no potential to support future military use.

Range Land Use Area 14 on Figure 2-1

Area Description. Includes BMGR lands underlying the R-2301W airspace that are east of the Gila and Tinajas Altas mountains and outside of the Cabeza Prieta NWR.

Area Size. 674 square miles, 431,642 acres

Military Land Use ~~X~~*Surface-to-Air and Air-to-Air Missile Firing Range, Troop Deployment Areas, TACTS Range Facilities, and Potential Future Surface Danger Zones.* This area serves a mix of Marine Corps and Navy training purposes (see Figure 1-2). On at least an annual basis, the portion of the area lying east of the Baker Peaks and Copper Mountains is used to support a live-fire validation test of the HAWK surface-to-air missile system. The same area is also used for firing Stinger surface-to-air missiles. The Stinger firings usually occur coincident with the HAWK missile exercise period. Both weapon systems are fired at remotely controlled target drones. All access to the test land area is suspended during the test period to protect the safety of civilians and military personnel and to prevent interruption of the test program.

Air-to-air missile firings within the R-2301W airspace are also scheduled on an irregular basis. These firings rely on Area 14 as the eventual impact area for the missile and target drone debris. This area is closed to public access during live-fire events.

A regularly scheduled Marine Corps use of the area is for ground troops deployment in support of the semiannual WTI course. Marine air defense, air control, communications, and command units select among 39 designated ground support areas approved for their use. Although total ground area available for Marine Corps use is only about two percent of Area 14 (or about 15 square miles), the distributions of the 39 support areas allow ground units to assume tactically realistic positions within the air-ground battlefield. Deployments (for other than missile firings) require that access to the BMGR 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.

The Marine Corps has completed a Final EIS for the Yuma Training Range Complex (YTRC) (DoD, Department of the Marine Corps 1997) and a Record of Decision is pending to establish five new ground support areas and three ground support zones within the BMGR and to discontinue the use of four existing ground support areas (see Figure 1-2). The three new zones and one support area (near Stoval Airfield) would be in Area 14. These changes would establish an aggregate of 34 square miles of support area/zones on the BMGR. Of these 34 square miles, 32.5 square miles would be in Area 14, which is 4.8 percent of the total area of Area 14.

An extensive array of TACTS range facilities are located within area 14. Existing facilities include (see Figure 1-2):

- # ten remote tracking and instrumentation subsystem stations
- # two fixed and several mobile electronic warfare emitters that simulate air defense radar signals
- # eleven simulated targets including airfields, parked aircraft, military vehicles, surface-to-air missile and anti-aircraft artillery sites, a power station, and a railroad station and building complex

An additional 12 threat emitters are approved and scheduled for installation; five others are proposed in the Final YTRC EIS. The 11 targets are used as aim points for a no bomb drop scoring system component of the TACTS. No weapons are used but electronically simulated air-to-ground attacks can be made and scored.

Public visitors to the area are instructed to remain clear of all TACTS Range facilities. The potential electronic radiation hazard that could be posed by threat emitters is alleviated by warning signs, chain-link security fencing at the emitter site, and electronic and physical barriers that prevent hazardous radar emissions from intersecting the ground.

Area 14 potentially has a future role as a surface danger zone that would underlie the trajectories of stand-off air-to-ground glide bombs, such as JDAM, and missiles fired from aircraft in the R-2301W airspace at targets within North or South TAC ranges from distances of 18 to 50 NM. Stand-off weapons of increasing 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. Stand-off weapons are planned for operational deployment on F-16, F-18, and AV-8B aircraft. This use on the BMGR appears likely, although such use may be limited and infrequent because of the high cost of stand-off munitions and the requirements associated with their use. All access to those portions of Area 14 and other BMGR areas that could potentially be impacted by an errant stand-off weapon round would have to be suspended during firing periods.

Range Land Use Area 15 on Figure 2-1

Area Description. Although the Moving Sands and Cactus West targets are located in Area 16 (see Figure 1-2), Area 15 includes BMGR lands underlying a portion of the R-2301W airspace that is reserved for these targets.

Area Size. 199 square miles, 127,409 acres

Military Land UseXAccess Control Area, Potential Surface Danger Zone, and Potential Troop Deployment Area. This area is managed to restrict access to the surface danger zone and laser hazard area associated with the Moving Sands and Cactus West target complex to the west. Public visitation to area 15 is authorized under permit only.

Permittees are warned about these hazards, briefed on the required travel restrictions, and provided with a map depicting areas open and closed to visitation.

Area 15 does not include any currently designated surface danger zones, but could serve as a potential weapons impact area for irregularly scheduled events such as air-to-air missile firings. All access to affected portions of this area would have to be suspended during such an event to protect the safety of civilians and military personnel and prevent interruption of the training exercise.

One of the ground support areas proposed in the Final YTRC EIS is located in Area 15. The support area is about 0.38 square mile (one square kilometer) in size and will be used to provide a deployment area for ground troops participating principally in the WTI course. The ground support area would be available for public access during non-military use periods.

Range Land Use Area 16 on Figure 2-1

Area Description. Includes the westernmost BMGR lands underlying R-2301W and incorporates AUX-2 and the Moving Sands and Cactus West Target Complex (see Figure 1-2).

Area Size. 151 square miles, 96,438 acres

Military Land UseXAuxiliary Airfield Operations, Parachute Drop Zone, Aerial Tow Target Drop Zone and Cable Cutter, Air-to-Ground Weapons Range, and Proposed Ground Support Areas. This area is managed principally to support flight operations at AUX-2 and air-to-ground weapons training at the Moving Sands and Cactus West Target Complex (see Figure 1-2). Two additional but limited activities near AUX-2 include the use of a parachute drop zone and an

aerial tow target cable cutter⁵⁶. Three new ground support areas for periodic troop deployments are proposed within Area 16. These sites total about 1.1 square miles in aggregate.

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 4,400 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 an 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 and taking-off of a LHA ship.

A second northeast-southwest oriented runway has a deteriorated macadam surface but 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 take-offs from unimproved surfaces, such as dirt roads. The third leg of the triangle is a range access road.

Construction of a new hard-surface roadway at AUX-2 is proposed in the Final YTRC EIS to support future AV-8B training in narrow-width roadway operations (also called road ops). This landing area will be sited adjacent to, and on the western side of, the present TLZ. It is proposed to be 4,200 feet long by 34 feet wide, and contain vertical take-off and landing pads at each end.

The TLZ also serves as a drop zone for tow banners used by the Marine Corps as aerial gunnery targets within the Chocolate Mountain Aerial 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.

MCAS Yuma completed an AICUZ study for AUX-2 in 1993 (U.S. Marine Corps 1993), which Marine Corps Headquarters approved in May 1994. Yuma County is currently working on zoning changes to adopt the AICUZ recommendations. The AICUZ study reported 42,928 operations annually at AUX-2 of which only 572 were helicopters. The projected level of use at AUX-2 after completion of the new runway is 51,280 (Southwest Division 1993).

A parachute drop zone used for training C-130 aircrews to perform cargo drops is presently located just west of AUX-2. In the Final YTRC EIS, the drop zone is proposed to be relocated to the retired Rakish Litter target bull's-eye positioned southeast of AUX-2 (see Figure 1-2).

Moving Sands and Cactus West target complexes provide a variety of controlled air-to-ground bombing and strafing targets. Both the Moving Sands and Cactus West complexes include air-to-ground rocket, bomb, and strafing targets. The Moving Sands complex also contains laser targets and 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.

⁵⁶ The cable cutter is a steel tower structure that guides a tow cable pulled by a low-flying aircraft to a notch with cutting edges that shear the cable as it is drawn into it. The device is used whenever a malfunction prevents a tow aircraft from releasing a towed aerial target prior to returning to base to land.

The purpose of the Moving Sands and Cactus West complexes is to provide aircrews with training in the basic mechanics of delivering air-to-ground ordnance in a structured and tightly controlled target setting. Both complexes have bull's eye type bombing targets with a current impact radius of 1,500 feet from the center point. Aircrew abilities to hit these targets and to critique the various attributes of their performance have been enhanced by the provision of lighting for night operations, a radar reflector, and a distance-marked 11.2-mile-long run-in line (see Figure 1-2). Target hits on both ranges are scored by a Weapons Impact Scoring System⁵⁷ (WISS). The strafing targets on both ranges are scored acoustically; the MLT on the Moving Sands range is not scored.

Air-to-ground ordnance delivery on the Moving Sands and Cactus West target complexes is restricted to the use of inert ordnance of up to 1,000 pounds.

To ensure that aircraft using these targets remain within current Moving Sands and Cactus West range boundaries, standardized entry points and flight tracks have been established for use of these ranges. The current entry/exit points and on-range tracks were established in a 1988 update to the 1986 Range Air Installation Compatible Use Zone (RAICUZ) study of the Moving Sands and Cactus West range complexes (Western Division 1988). The 1988 update addresses changes in the entry and exit points to R-2301W associated with the use of the Moving Sands and Cactus West targets; consequent changes in flight patterns to target approach and fly-over; and a more precise determination of target coordinates, noise contours, and range safety.

As documented in the YTRC EIS, the Marine Corps proposes to add three new ground support areas for troop deployments in Area 16 to enhance the realism of the WTI course. The new support areas would increase the geographical options air defense and communications commanders would have for deploying their units in tactically realistic positions.

Because of the hazardous nature of the military activities that occur at and around AUX-2 and Moving Sands and Cactus West, all access to Area 16 is restricted. Public visitation is not authorized.

Range Land Use Area 17 on Figure 2-1

Area Description. Includes the BMGR lands that are located west of the R-2301W airspace.

Area Size. 60 square miles, 38,089 acres

Military Land Use Cannon Air Defense Complex, Rifle Range, EOD Operations, and Access and Encroachment Control. This area supports a mix of military activities. 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 1-2). The complex is a

⁵⁷ WISS is basically an automated television camera/computer system that detects and triangulates the locations of bomb hits within the target impact areas.

permanent facility of about 0.3 square miles in size with a developed cantonment area. The perimeter is fenced to deter unauthorized access.

The rifle range and pistol range are 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 1-2). The rifle range has 30 firing lanes and is used by MCAS Yuma personnel to meet proficiency requirements for the use of small arms.

Two EOD operating areas are located in Area 17 (see Figure 1-2). One is positioned close to and southwest of AUX-2. This area 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 4.5 NM 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.

The jettison area is the old bull's eye of the former Panel Stager target. This target was retired in 1986 when it was replaced by the new Moving Sands and Cactus West target complex. EOD personnel are tasked to recover jettisoned bombs and drop tanks following each release event.

The proposed Yuma Area Service Highway alignment would pass through a portion of Area 17 if the highway is approved and constructed. The highway would serve as a public use transportation corridor. The highway right-of-way would be fenced on both sides for at least the portion passing through the BMGR to control access onto the range.

Access to Area 17 is restricted to protect the safety of civilians and military personnel and to prevent interruption of the activities that occur there. Closure of this area to public use is also necessary to help deter unauthorized access to AUX-2 and the Moving Sands and Cactus West target complexes to the east. Military management has the further benefit of precluding new land uses that would not be compatible with the noise environments generated by intensive low-level aircraft operations at AUX-2 and Cactus West.

Range Land Use Area 18 on Figure 2-1

Area Description. Includes right-of-way easement for Interstate Highway 8 and Union Pacific Railroad.

Area Size. 0.8 square mile, 516 acres

Military Land UseXHighway and Railroad Easement. The purpose of the highway and railroad easement is to provide public transportation through a small northern projection of the BMGR. Interstate 8 is used periodically by military vehicles, but has no military purpose.

Range Land Use Area 19 on Figure 2-1

Area Description. Includes the BMGR lands located between the R-2301E airspace and the railroad north of Stoval Auxiliary Airfield.

Area Size. 1.8 square miles, 1,128 acres

Military Land Use~~X~~*Ground Support Area.* This area is used to support field deployments by Marine air defense and communications units during the semiannual WTI course. The area also provides surface access to the Stoval Auxiliary Airfield.

Range Land Use Area 20 on Figure 2-1

Area Description. Includes a series of small parcels north and south of Interstate 8.

Area Size. 0.8 square mile, 524 acres

Military Land Use~~X~~These small disjointed parcels lie outside of the R-2301W/E airspace. Several parcels are north of Interstate 8; none of the parcels have any military utility.

2.2.3 Ongoing Management Actions

Renewal of the land withdrawal under the proposed action would continue the existing overall pattern of military land and airspace use for the foreseeable future. With the proposed action, the management actions to mitigate environmental impacts would also continue. These management actions have been implemented to avoid, minimize, rectify, reduce, or compensate for impacts caused by the military operations on the BMGR.

Some effects of military operations—such as inert munitions impacts, a limited scope of live ordnance detonations, and some off-road use of military vehicles—cannot be avoided. These effects, which are described in Chapter 4.0, would be continued with the proposed action, but management actions to mitigate the effects would continue to be implemented and new mitigation would be developed where practical.

The ongoing management actions, which would continue with the proposed action, are summarized by resource area below.

Airspace and Range Operations

No mitigation measures for military airspace and range operations are required to offset the effects of the proposed action.

- # The surface use footprint of military operations would be kept to the minimum necessary. A comprehensive review of BMGR operations that was completed in support of the draft LEIS has generated a computer automated inventory of military air and surface uses housed within a geographic information system. This system would greatly assist continuing monitoring efforts to track, assess, and control military surface use requirements. An early use of this new management approach is an ongoing assessment by the Air Force to determine if the size of EOD sweep areas on the range can be decreased without compromising range safety standards. A decrease in the extent of these sweep areas would reduce requirements for off-road vehicle use and range operating costs.

Non-military Land and Airspace Use

- # No mitigation measures for non-military land and airspace use are required to offset the effects of the proposed action.

Public Utilities and Ground Transportation

- # No mitigation measures for public utilities and ground transportation are required to offset the effects of the proposed action.

Noise

- # The hours of operation and flight procedures at Gila Bend AFAF and AUX-2 would continue to be evaluated, with consideration of flight safety and mission requirements, to review the noise impacts to sensitive land uses, such as residences.

Public Health and Safety

- # Large portions of the BMGR, including manned ranges, tactical ranges, target areas, and other high hazard areas, would continue to be unavailable for public use in order to keep people away from high hazard areas.
- # Public access to the BMGR would continue to be authorized only after completion of the permit process, which would include signing a hold harmless agreement.
- # EOD teams would continue to clear munitions from the surface of the manned and tactical ranges, and the Moving Sands/Cactus West target complex.
- # Fences and/or warning signs marking the boundary of the BMGR as well as interior hazard areas such as live-fire ranges, laser hazard areas, EOD operating areas, and abandoned mines and wells, would continue to be posted and maintained.
- # A periodic survey of access points along the range perimeter and of interior hazard areas would be conducted to ensure that needed safety fences, gates, and signs are in place.

Cultural Resources

- # Avoidance of identified cultural sites would continue when possible through restructuring or redesigning military activities.
- # Educational briefings and programs would be developed and administered to employees who work on the range as well as military field personnel to increase their awareness of cultural resource protection requirements.
- # The effects of unavoidable disturbance to archaeological sites would be mitigated through data recovery projects designed to recover a representative sample of information.
- # Archival research would continue to be conducted to record, compile, and preserve information on prehistoric and historic resources.
- # Oral histories would continue to be recorded to preserve information on cultural traditions or events.
- # Selected samples of similar or nearly identical historic property types (such as World War II airfields) would continue to be identified and preserved in order to save representative examples of earlier use on the BMGR.
- # Public education programs would be developed to increase awareness of cultural resource protection. This would include development of a Site Stewards Program specific to cultural resources on the BMGR.
- # Access by Native Americans to sacred sites and traditional cultural places that may be identified on the BMGR would be accommodated to the extent practicable and consistent with military training requirements.
- # The BMGR Integrated Cultural Resource Management Plan, currently under development, would be implemented as a compliance and mitigation management tool.

Socioeconomic Resources

- # No mitigation measures for socioeconomic resources are required to offset the effects of the proposed action.

Visual Resources

- # No mitigation measures for visual resources are required to offset the effects of the proposed action.

Recreation

- # No mitigation measures for recreation are required to offset the effects of the proposed action.

Hazardous Materials and Waste

- # The Newcomers Environmental Awareness briefing given to all Luke AFB personnel would continue to be implemented to increase awareness about the proper transportation, handling, use, and disposal of hazardous materials and wastes and methods for pollution prevention.
- # Efforts would be continued to reduce or eliminate the use of hazardous materials and waste generation.
- # Personnel in the field would continue to be required to implement spill prevention, control, and countermeasures.
- # Trained Air Force and Marine Corps emergency response teams would continue to be available to respond to releases of hazardous materials on the range.

Earth Resources

- # Ongoing management practices to minimize the surface disturbing effects of military activities; to prevent, contain, and clean-up spills of hazardous or toxic materials; and to contain and remediate the effects of aircraft crashes would continue to minimize the potential effects of military use of the range on earth resources.
- # EOD work to decontaminate target areas would continue to minimize the presence of expended munitions on the range, thus reducing the potential for hazardous constituents contained in some ordnance to affect soils.

Water Resources

- # Ongoing management practices to minimize the surface disturbing effects of military activities; to prevent, contain, and clean-up spills of hazardous or toxic materials; and to contain and remediate the effects of aircraft crashes would continue to minimize the potential effects of military use of the range on water resources.
- # EOD work to decontaminate target areas would continue to minimize the presence of expended munitions on the range, thus reducing the potential for hazardous constituents contained in some ordnance to affect surface water or groundwater resources.

Air Quality

- # No mitigation measures for air quality are needed to offset the effects of the proposed action.

Biological Resources

The management actions outlined below apply specifically to special status species; however, many of these actions also serve to protect other biological resources.

- # Potential impacts to the endangered Sonoran pronghorn would continue to be minimized by eliminating use of full-scale live or inert ordnance on South Tactical Range and maintaining a minimum flight altitude of 500 feet above ground level during the fawning season between 1 March and 15 April. All users of the BMGR would receive briefings on the importance of reducing impacts to Sonoran pronghorn.
- # Sonoran pronghorn habitat loss, degradation, and fragmentation would continue to be minimized by limiting surface disturbance, minimizing erosion during construction work, preventing pollution of soil and drainages, controlling speed limits on roadways, determining aluminum levels in water and forage plants, and restricting vehicles to existing and designated roads. EOD, environmental, and archeological personnel, however, would continue to be authorized to use vehicles off of existing and designated roads when necessary to perform required duties. Such off-road use would continue to be monitored in accordance with the terms of the Section 7 consultation with the USFWS.
- # Reactions of Sonoran pronghorn to military activities would continue to be monitored and studied, as necessary.
- # Personnel and visitor educational programs and well-defined operational procedures on the importance of reducing impacts to the flat-tailed horned lizard (a wildlife species of special concern in Arizona) would continue to be implemented.
- # To the extent possible, military activities would continue to be located outside of flat-tailed horned lizard habitat.
- # Flat-tailed horned lizards would be moved from harm's way when possible adverse effects could not be otherwise avoided.
- # The Air Force, BLM, and MCAS Yuma, as appropriate, would continue to implement the measures contained within the Flat-tailed Horned Lizard Rangelwide Management Strategy (completed in May 1997).
- # Incidental take (to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect that is not intended as part of the agency action) of any special status species resulting from military activities would continue to be monitored and reported to the USFWS. Monitoring for incidental take is an ongoing function and the Air Force would continue to explore new methods of monitoring to satisfy this requirement.

Environmental Justice

- # The Air Force and Marine Corps would continue to evaluate flight operations at Gila Bend AFAF and AUX-2 (with consideration of flight safety and training requirements) so that measures could be taken, when possible and practical, to minimize noise effects at nearby residences identified as minority and low-income.

- # The Luke AFB Native American liaison would continue to address complaints from Native American tribes about BMGR operations.

2.3 ALTERNATIVE ACTION

The alternative action for the BMGR differs from the proposed action only in terms of the duration of the withdrawal. All of the other elements of the alternative action are identical to those described in Section 2.2 for the proposed action.

The alternative action calls for the range to be withdrawn and reserved for a period of 25 years. The alternative specifies the Air Force would have the option, at the close of the 25-year period, to request that Congress renew the land withdrawal for a follow-on 25-year period if there is a continuing military need for the range. Relative to the current 15-year withdrawal, a range renewal of 25 years more reasonably approximates weapons systems life cycles and would enhance efforts to manage military and non-military land use from an integrated perspective. Renewal of the 25-year withdrawal would require the Air Force to publish documentation to comply with NEPA for military need for the range and the expected environmental consequences of another renewal. The publication deadline for the draft EIS would likely be 22 years following the date that the 25-year withdrawal becomes law. This projected publication date parallels the requirements of P.L. 99-606, which provided that the draft EIS for range renewal would be published three years prior to the expiration of the withdrawal.

The ongoing management actions that were discussed in Section 2.2.3 for the proposed action would also apply to renewal of the land withdrawal under the alternative action.

2.4 NO-ACTION ALTERNATIVE

The BMGR land withdrawal would not be renewed under the no-action alternative. Military surface use of the range would end including missions involving live-fire use of air-to-air or air-to-ground munitions. All ground-based military equipment and other assets would be removed. The no-action alternative would not mean that military use of the overlying restricted airspace would end. Military flight operations that do not require an air-to-ground or ground support component could be performed in the absence of the BMGR land withdrawal.

The USFWS currently has surface management jurisdiction over the Cabeza Prieta NWR section of the BMGR and would continue to do so following expiration of the military withdrawal and reservation. The Cabeza Prieta NWR would not be opened to entry under the mining laws or most other forms of appropriation under the public land laws because these uses are excluded by the Arizona Desert Wilderness Act of 1990 (P.L. 101-628).

The BLM would assume full jurisdiction over the remaining federal public lands of the BMGR with the exception of former state and private lands purchased by the Air Force. The BLM lands would be managed pursuant to the Federal Land Policy and Management Act of 1976 (FLPMA, P.L. 94-579) and other applicable laws and regulations.

The AGFD, which administers the state's interests in wildlife and habitat management, would continue to have this role following expiration of the land withdrawal.

Management of these former range lands would continue to be directed by the Lower Gila South Resource Management Plan (RMP) Goldwater Amendment until new management planning under FLPMA and NEPA regulations could be completed. Although withdrawal of these lands under P.L. 99-606 from all forms of appropriative land use (such as mining, geothermal leasing, or livestock grazing) would expire, segregation of these lands from appropriative land uses would continue until such time that the Secretary of the Interior could publish an order opening the lands for such uses. An opening order could not be issued by the Secretary until the costs, benefits, and environmental consequences of competing land use could be fully evaluated through planning directed by FLPMA and reported in NEPA documentation. Land uses that would have to be considered would include appropriative (as described above) and non-appropriative uses. Examples of non-appropriative land use include developed and dispersed recreation, wildlife enhancement, and various types of conservation or preservation management. The results of new land management planning may or may not find that portions or all of the former BMGR lands managed by the BLM should be opened to some or all forms of appropriative land use.

The Air Force would continue to have jurisdiction over 2,675 acres of former privately owned land and 81,121 acres of former Arizona State Trust lands which were purchased by the Air Force. The Air Force would likely have no continuing military need for these scattered parcels following non-renewal of the land withdrawal and would probably initiate action to declare the affected lands as excess.

A number of actions pertaining to the potential contamination of some range land by expended munitions or other materials are specified by P.L. 99-606. Responsibility for these actions lie with the Secretaries of the Interior and Air Force. If the Secretary of the Interior does not accept jurisdiction over some or all of the BMGR lands because of contamination, then the Secretary of the Air Force:

- # must take appropriate steps to warn the public about the contaminated status of the subject properties and the risks associated with entering those lands
- # would be denied use of the contaminated lands after the withdrawal expires except for continuing decontamination activities
- # must report to the Secretary of the Interior and the Congress regarding the continuing contamination status of the lands and ongoing decontamination efforts

As indicated in Chapter 1.0, this draft LEIS does not attempt to forecast the character of the mission changes that would be precipitated by a Congressional decision to allow the land withdrawal and reservation for the BMGR to expire. The scale of operations at the BMGR is of such proportions that the loss of the range would have far reaching effects on military bases and

other ranges throughout the Air Force, Marine Corps, Navy, Army, ANG, ARNG, and Air Force Reserves. The likely course of action in the event of a decision to not renew the land withdrawal would be a Congressional extension of the range for a finite period to provide the DoD with time to prepare plans for mission changes that would be necessary to cope with the loss of the BMGR, prepare appropriate environmental documentation, and drawdown and relocate selected missions from the BMGR without adversely affecting national defense readiness.

No specific details are provided here as to how non-renewal of the range would affect other military bases, other airspace, or other ranges. Some potential general effects at the BMGR can, however, be recognized. The restricted airspace at the range could possibly be reconfigured and retained to support some continuing aerial training missions that do not involve live weapons use. Alternatively, the former range airspace may be converted to a MOA/ATCAA complex to support non-hazardous aerial training activities. However, the extent to which airspace conversion could be a realistic proposal cannot be specifically determined at this time, and this draft LEIS does not propose a change in the airspace structure.

2.5 MILITARY ADMINISTRATION SCENARIOS

As introduced in Section 2.1, sub-alternatives or scenarios were added to the environmental impact assessment process as a result of input received from the public and cooperating agencies during scoping for the draft LEIS. The scenarios are relevant only if the BMGR land withdrawal is renewed. The first set of scenarios addresses military administration.

From the perspective of tactical aviation training, the restricted airspace and lands of the BMGR form an integrated environment within which the air-ground battle area can be effectively simulated to support realistic training. From the perspective of airspace administration, however, the range is currently segregated into two airspaces and three land sections (Figure 2-2). The range airspace is divided into the Air Force and Marine Corps airspace sections. The Air Force airspace section includes restricted areas R-2301E, R-2304, and R-2305. The Marine Corps airspace section is limited to restricted area R-2301W. The range land sections include the eastern, western, and Cabeza Prieta NWR sections. Four federal agencies have primary responsibilities for administering these range airspace and land sections. Included are the Air Force, Marine Corps, BLM, and USFWS. As implied by the view of the range provided by Figure 2-2, the geographic extent of these agencies' responsibilities are in some ways segregated and in others overlap. These circumstances are currently in effect as a result of the provisions of P.L. 99-606 and the military requirements for including the Cabeza Prieta NWR within the range land withdrawal.

P.L. 99-606 provides that the range lands are "...reserved for use by the Secretary of the Air Force..." which has the effect of assigning the administrative responsibility for the entire military reservation to the Air Force. Details on how the Air Force meets this responsibility through the 56th FW/Range Management Office (RMO) at Luke AFB are examined in Table 2-1. The Air Force, again through the 56th FW/RMO, is also the designated using agency for all of the restricted airspace XR-2301W, R-2301E, R-2304, and R-2305X of the BMGR and is the agency

that schedules use of R-2301E, R-2304, and R-2305 for all users (see Table 2-1). This authority for the range airspace is delegated to the Air Force by the FAA, which is the Congressionally designated controlling agency for all airspace in the United States.

The Marine Corps has been the principal military user of the western side of the BMGR since January 1959 (see Appendix C). The Marine Corps's current administrative responsibilities for that portion of the range are specified in a 1982 Letter of Agreement (LOA) between the Air Force and Navy. Those responsibilities include serving as the scheduling agency for the R-2301W airspaces, management of Marine Corps/Navy activities within the western land section, and preparing required environmental documentation for such activities (see Table 2-1).

After the establishment of the Luke-Williams Air Force Range in 1941 and prior to P.L. 99-606, the General Land Office (and later the BLM's) role was limited principally to real estate and subsurface minerals management. That federal statute elevated the BLM's administrative responsibilities and involvement in the range by providing that the Secretary of the Interior would manage the withdrawn lands of the BMGR except those range lands that are within the Cabeza Prieta NWR. BLM management of these lands is guided by P.L. 99-606 which gives primacy to the military mission and withdraws the range from all forms of appropriative land

FIGURE 2-2
BMGR LAND AND AIRSPACE ADMINISTRATIVE SECTIONS
8 ½ x 11 B/W

TABLE 2-1 EXISTING BMGR LAND AND AIRSPACE ADMINISTRATIVE SECTIONS		
BMGR Section	Size*	Administrative Agencies
All Land Sections	4,163 square miles or 2,664,423 acres per P.L. 99-606; 4,169 square miles or 2,668,100 acres per <i>Federal Register</i> legal description	<u>Air Force</u> : The 56 th FW/RMO, Luke AFB, has been delegated as the local administrative command for military use of the entire BMGR land reservation. As the host command, Luke AFB exercises management control for all military use of the range, approval authority for all military construction, and environmental management and documentation responsibility for all military activity. <u>AGFD</u> : While not an administrator of the existing BMGR land or airspace, the AGFD is responsible for managing the state's wildlife, including the wildlife found in the BMGR.
Eastern (Land) Section	1,806 square miles or 1,155,908 acres	<u>Air Force</u> : Luke AFB is the scheduling agency and principal user of the eastern section. Luke AFB controls all access to this land section, schedules all military use, manages all military construction, is responsible for all explosive ordnance disposal (EOD) and target range cleanup, and for documenting and managing the environmental effects of military activities. <u>BLM</u> : While access to the range is controlled by the DoD permit system, the Phoenix Field Office of the BLM is the designated surface management authority for eastern section lands. In this role, BLM responsibilities include natural and cultural resource management, control of all non-military land use, and environmental documentation for non-military actions. BLM management occurs only with concurrence from DoD.
Western (Land) Section	1,085 square miles or 694,343 acres	<u>Navy/Marine Corps</u> : MCAS YumaXas delegated by a 1982 Letter of Agreement (LOA) between Commander, Twelfth Air Force and Commander, Third FleetXserves as the local command for managing Navy and Marine Corps use of the western section. MCAS Yuma is responsible for scheduling military use, managing military construction, EOD and military range cleanup, and environmental documentation for Navy and Marine Corps activities. MCAS Yuma is the principal military ground user of the western section and user of the overlying R-2301W airspace. <u>Air Force</u> : Per the 1982 LOA, Luke AFB retains jurisdiction for management control over the western section and approval authority for any land action, construction, and access and control procedures proposed by the Navy/Marine Corps. Navy/Marine Corps environmental compliance activities must also be coordinated with the Air Force. <u>BLM</u> : While access to the range is controlled by the DoD permit system, the Yuma Field Office of the BLM is the designated surface management authority for western section lands. In this role, BLM responsibilities include natural and cultural resource management, control of all non-military land use, and environmental documentation for non-military actions. BLM management occurs only with concurrence from DoD.
Cabeza Prieta NWR (Land) Section	1,278 square miles or 818,106 acres per GIS analysis; 1,284 square miles or 822,000 acres per Cabeza Prieta NWR Draft Comprehensive Management Plan	<u>USFWS</u> : Per P.L. 99-606, more than 95 percent of the 860,010 acres of the Cabeza Prieta NWR is also included within the BMGR. The military withdrawal overlays the withdrawal for the refuge but does not supersede it. Thus, most of the refuge has been assigned concurrent dual purposes by CongressXmilitary reservation and national wildlife refuge. Military use of the Cabeza Prieta NWR surface, however, is currently limited by interagency agreements (left in force by P.L. 99-606 and the Arizona Desert Wilderness Act of 1990 [P.L. 101-628]) to four sites for remote GRMDS stations and one remote TACTS station, and as a potential aerial ordnance/target fall out area. Almost 98 percent (or 803,418 acres) of the refuge is designated as wilderness. Nearly all of this acreage is within the BMGR. The Cabeza Prieta NWR office of the USFWS is the designated surface management authority for the Cabeza Prieta NWR and Wilderness.
Cabeza Prieta (continued)		This authority includes natural and cultural resources management, control of all non-military land use, environmental documentation for non-military activities, and access control for surface entry. The entire refuge is overlain by restricted airspace (R-2301W/E) which extends from the land surface to 80,000 feet MSL. The USFWS

TABLE 2-1 EXISTING BMGR LAND AND AIRSPACE ADMINISTRATIVE SECTIONS		
BMGR Section	Size*	Administrative Agencies
		does not have jurisdiction to control use of R-2301W/E. The airspace above 1,500 feet AGL is used routinely for military flight training activities. The airspace below 1,500 feet AGL is used for military flights only within low-level corridors designated by Memorandum of Understanding between the military and USFWS as required by P.L. 99-606. <u>Air Force/Marine Corps:</u> The Air Force and Marine Corps retain the authority to temporarily close surface access to the BMGR portion of the Cabeza Prieta NWR if warranted to protect public safety from potentially hazardous airspace activities such as air-to-air missile firing (ordnance or targets may fall within the refuge).
Air Force Airspace Section	R-2301E: 2,068 square miles or 1,323,520 acres R-2304: 457 square miles or 292,430 acres R-2305: 242 square miles or 154,880 acres	<u>Air Force:</u> Luke AFB, 56th RMO/Airspace Management (RMO/ASM), is the FAA designated using and scheduling agency for R-2301E, R-2304, and R-2305. The Air Force is also the principal user of this airspace.
Marine Corps Airspace Section	R-2301W: 1,556 square miles or 995,840 acres	<u>Air Force:</u> Luke AFB, 56th RMO/ASM, is the FAA designated using agency for R-2301W. <u>Navy/Marine Corps:</u> MCAS Yuma is the scheduling agency for R-2301W as delegated by the Air Force in the 1982 LOA. The Marine Corps is the principal user of R-2301W.
* P.L. 99-606 specifies that the BMGR includes 2,664,423 acres of withdrawn land. An analysis of the BMGR land area using an ARC/INFO™ packaged geographic information system (GIS) shows the range perimeter to include 2,668,357 acres, an increase that is 0.15 percent over the official figure but is within 0.01 percent of the legal description area of 2,668,100 acres. The BMGR and Cabeza Prieta NWR perimeters used in the GIS analysis were obtained from the Arizona State Land Department electronic database. Subsection areas were also determined using this range perimeter. All BMGR subsection acreages reported here are based on GIS analysis.		

use. The current BLM management plan applicable to the western and eastern sections is the Lower Gila South RMP Goldwater Amendment, which became effective in November 1990. The BLM has no jurisdiction for the restricted airspace overlying the range.

The USFWS is the surface management authority for the Cabeza Prieta NWR and Wilderness (see Table 2-1). With the exception of five remote mountain sites within the refuge used for GRMDS and TACTS range instrumentation and continued service by the refuge as a potential fall out area for expended aerial ordnance or targets, surface uses of refuge lands by the military do not occur. (The role of the Cabeza Prieta NWR as a potential ordnance fall out area is described in detail in Section 2.2.2.) The USFWS has no jurisdiction for the restricted airspace overlying the refuge.

2.5.1 Scenario A1: Renew the BMGR as One Military Reservation

Scenario A1 would renew the BMGR as one military reservation reserved for use by the Secretary of the Air Force, thus continuing the military administration conditions established by P.L. 99-606 (Figure 2-3). The Air Force would continue to serve as the designated overall military administrator for the entire

BMGR and as the scheduling agency, principal user, and DoD manager of the eastern land section and the R-2301E, R-2304, and R-2305 airspaces (see Table 2-1). Scenario A1 would leave the 1982 LOA in effect and the Marine Corps would remain as the delegated scheduling agency, principal user (along with the Navy), and manager of its own activities within the western land section until it is agreed that the LOA should be renegotiated. It is anticipated that the LOA may be updated, but would likely result in a similar agreement. The Marine Corps role as the scheduling agency for R-2301W would be unaffected. As the overall military administrator of the range, the Air Force would retain jurisdiction to exercise management control over military use of the western land section and approval authority for proposed construction and access and control procedures. MOUs and LOAs placed in effect since P.L. 99-606 would also remain in effect unless otherwise indicated or superceded.

2.5.2 Scenario A2: Renew the BMGR as Two Military Reservations

Scenario A2 would renew the BMGR as two military reservations: one reserved for use by the Secretary of the Air Force, the other for use by the Secretary of the Navy (Figure 2-4). Under this split military administration scenario, the Air Force would be the designated using and scheduling agency for the eastern land section of the BMGR. The Air Force would also remain as the using and scheduling agency for the R-2301E, R-2304, and R-2305 airspaces. Although the western side of the BMGR would be reserved for use by the Secretary of the Navy, the Marine Corps would be the designated using and scheduling agency for the western land section. In an action following range renewal, the FAA would be asked to designate the Marine Corps as the using and scheduling agency for the R-2301W airspace.

Split administration would not affect integrated use of the entire range to support training exercises such as the WTI course or future use of long-range missiles or stand-off weapons that may require concurrent scheduling of the R-2301W, R-2301E, and possibly the R-2304 and R-2305 airspaces. The reciprocal scheduling privileges and procedures that the Air Force, Marine Corps, and Navy currently share under the 1982 LOA would be continued under a range renewal with split administration unless a new LOA is negotiated that changes the existing arrangements.

Independent administration of the western land section of the BMGR by the Marine Corps would end the management control authority and the environmental compliance approval responsibility for Marine Corps land use and activities that the Air Force now holds as the overall military administrator of the range. The Marine Corps would assume full responsibility for such

FIGURE 2-3
MILITARY ADMINISTRATION RESPONSIBILITY UNDER RENEWAL SCENARIO A1
8 ½ X 11 B&W

FIGURE 2-4
MILITARY ADMINISTRATION RESPONSIBILITY UNDER RENEWAL SCENARIO A2
8 ½ X 11 B&W

documentation under Navy and Marine Corps regulations for implementing the NEPA, Endangered Species Act, National Historic Preservation Act, and other applicable environmental compliance laws.

Assuming the BMGR were renewed as two military reservations and the Air Force ever determined that it no longer needed the eastern land section, the Marine Corps would request the first opportunity to administer the eastern land section. Similarly, if the Marine Corps ever determined that it no longer needed the western land section, the Air Force would request the first right of refusal for that land.

2.6 WITHDRAWAL LAND AREA SCENARIOS

2.6.1 Scenario B1: Renew the Existing BMGR Withdrawal Land Area

Renewal Scenario B1 proposes that the full existing land area of the BMGR be rewithdrawn (Figure 2-5). The legal description for the existing range withdrawal specifies that the range includes 2,668,100 acres of public lands in Maricopa, Pima, and Yuma counties, Arizona. Included in the renewal would be 1,764,979 acres of land managed by the BLM; 81,121 acres of former Arizona State Trust lands, purchased by the Air Force; and 822,000 acres that are within the Cabeza Prieta NWR and managed by the USFWS. These acreages are the same as those in the current withdrawal authorized by P.L. 99-606. The withdrawn lands would be reserved for use by the Secretary of the Air Force, and possibly the Secretary of the Navy under Scenario A2, for an armament and high-hazard test area; training for aerial gunnery, rocketry, bombing, electronic warfare, and tactical maneuvering and air support; and other defense-related purposes. These purposes reflect the military uses of the BMGR that have occurred since the World War II era and that would meet military requirements for the range into the foreseeable future.

2.6.2 Scenario B2: Renew a Reduced BMGR Withdrawal Land Area

Renewal Scenario B2 proposes that up to three parcels of land not be included in the BMGR renewal land withdrawal. These parcels include the Sand Tank Mountains, Sentinel Plain, and Ajo Airport areas (see Figure 2-5). As previously explained, the Sand Tank Mountains area is currently managed by the Air Force to (1) prevent unauthorized entry into East TAC Range and Manned Range 3, and (2) exclude land uses within the area that would be incompatible with low-level military overflights and aircraft and ordnance detonation noise from East TAC Range and Manned Range 3. The Sentinel Plain area is similarly managed to (1) prevent unauthorized entry into Manned Range 4 and North TAC Range, and (2) exclude incompatible land use within properties adjacent to these live-fire ranges. The range properties surrounding the Ajo Airport do not support range operations by performing access and encroachment control functions.

The access and encroachment control functions provided by the Sand Tank Mountains and Sentinel Plain areas are important to the safe and uninterrupted operation of the BMGR. The proposal not to include these two areas within the BMGR renewal land area must accordingly be contingent on the condition that these areas would be managed by the BLM in a manner that

would maintain these access and encroachment control functions. A commitment in this matter, either through the language of the renewal legislation or some regulatory function, is necessary in order for the Air Force to support non-renewal of these areas. The Air Force could accept non-renewal of the Ajo Airport area without stipulations.

Details of the proposed Sand Tank Mountains, Sentinel Plain, and Ajo Airport non-renewal areas and the proposed BMGR boundaries that would result from non-renewal are shown in Figures 2-6, 2-7, and 2-8, respectively. The Sand Tank Mountains, Sentinel Plain, and Ajo Airport areas encompass 83,554, 24,756, and 2,779 acres, respectively. The stairstep like boundaries shown for the Sand Tank and Sentinel Plain areas follow quarter section lines. The stairstep boundary configuration is proposed to ensure that all existing BMGR property underlying the R-2301E, R-2304, or R-2305 airspaces that may be affected by the non-renewal proposals would remain within the remaining range renewal area. The western side of the proposed Ajo Airport non-renewal area follows the western side of the State Route 85 right-of-way easement through the existing range withdrawal.

The three areas proposed for non-renewal are functionally independent from each other. One, two, or all three could be excluded or included in the renewed land withdrawal without effect on each other. The BMGR would have a land area of 2,557,011 acres if the Sand Tank Mountains, Sentinel Plain, and Ajo Airport areas are all excluded from the range renewal.

P.L. 99-606 provides that because of potential contamination by expended munitions or other materials, a number of actions would have to take place before the Department of the Interior could accept jurisdiction over any BMGR parcels for which the Air Force no longer has a continuing military need. In summary, before jurisdiction over parcels that are not to be included in the BMGR renewal could be transferred, the extent to which these lands are contaminated with explosive, toxic, or other hazardous material would have to be reviewed. Further, the requirements for and feasibility of decontaminating the lands would have to be determined. An undetermined potential exists that contamination in some locations could delay or preclude jurisdictional transfer. These actions would be applicable to any or all of the Sand Tank Mountains, Sentinel Plain, or Ajo Airport areas should they not be included in the BMGR renewal.

Following jurisdictional transfer, BLM management of the Sand Tank Mountains, Sentinel Plain, or Ajo Airport parcels would occur pursuant to the FLPMA. The management of these lands would continue to be directed by the Lower Gila South RMP Goldwater Amendment until such time that new management planning under FLPMA and NEPA regulations could be completed. AGFD would continue to manage wildlife on these parcels.

Although withdrawal of these lands under P.L. 99-606 from all forms of appropriative land use would expire, segregation of these lands from appropriative land uses would continue until such time that the Secretary of the Interior could publish an order opening the lands for such uses. An opening order could not be issued by the Secretary until the costs, benefits, and environmental consequences of an appropriate form of competing land use could be fully evaluated through planning directed by FLPMA and NEPA requirements. Three criteria for determining the appropriateness of proposed land uses within the Sand Tank Mountains and Sentinel Plain areas would be the compatibility of such uses with (1) the access constraints necessary to prevent unauthorized entry of the adjacent BMGR live-fire ranges, (2) the noise generated by BMGR aircraft and ordnance delivery operations, and (3) low-level overflights by military aircraft entering or leaving the BMGR or loitering prior to entry.

Given these constraints, any of a variety of appropriative and non-appropriative land uses are potential candidates for detailed consideration. The results of new land management planning may or may not find that portions or all of the former range lands should be opened to some or all forms of appropriative land use.

Withdrawal revocation of lands previously part of a military reservation has occurred successfully in the past. For example, the Muggins Mountains Wilderness Area was once part of the Yuma Proving Ground.

2.7 SCENARIOS FOR THE ADMINISTRATION OF NATURAL AND CULTURAL RESOURCES MANAGEMENT

The following sub-alternatives or scenarios present options for federal agency assignments for administering natural and cultural resources management. The scenarios do not propose specific management policies, goals, or objectives for managing these resources. The scenarios would not alter the authorities of state or local agencies with jurisdiction for resources on the BMGR.

In contrast to most federal properties for which a single federal agency has the primary responsibility for managing land use and natural and cultural resources, the BMGR is characterized by a complex division of multiple federal agency involvements in these concerns. Given that the range was reserved by Congress for military aviation training and other defense related purposes, military operations dictate the primary land use patterns within the eastern and western land sections of the range. Per P.L. 99-606, the BLM is responsible for managing BMGR lands outside of the Cabeza Prieta NWR but the necessary primacy of the military mission affects opportunities to manage these lands for other uses. The Air Force and Marine Corps also have important management roles stemming from the control and exercise of their own surface uses and from their responsibilities to meet environmental compliance and management requirements associated with their actions. The responsibility of DoD agencies to exercise management stewardship for the natural and cultural resources of military reservations

FIGURE 2-5
LAND WITHDRAWAL AREAS FOR SCENARIOS B1 AND B2
11 X 17 B&W

FIGURE 2-6
SAND TANK MOUNTAINS NON-RENEWAL AREA
8 ½ X 11 B&W

FIGURE 2-7
SENTINEL PLAIN NON-RENEWAL AREA
8 ½ X 11 B&W

FIGURE 2-8
AJO AIRPORT NON-RENEWAL AREA
8 ½ X 11 B&W

is generally derived from the Sikes Act of 1960 (P.L. 86-797) and its periodic amendments (most recently P.L. 105-85). As the overall DoD administrator of the range, the Air Force has also invested considerable personnel and fiscal resources in the survey and evaluation of natural and cultural resources as well as range roads and military infrastructure. The Air Force embarked on this program in order to ensure that the information needed be available not only to assess the environmental consequences of the proposed land withdrawal renewal but also to support effective range stewardship by all involved agencies.

Federal surface management within the Cabeza Prieta NWR has been the sole responsibility of the USFWS, but as a component of the BMGR the refuge is affected by some military operations. The USFWS is also responsible for regulating the management of endangered species wherever they are found.

The state of Arizona has a variety of interests in the BMGR including public access, wildlife and cultural resource management, and native plant protection among others. As the agency responsible for the management of the state's wildlife, AGFD has the most direct and extensive involvement among state agencies in the range.

The agencies identified above by no means complete the list of federal and state agencies with interests in or activities on the BMGR. The agencies identified, however, hold the primary responsibilities for the use of the range and for its natural and cultural resources. While each of the identified agencies has its own specific mission, their interests and responsibilities on the BMGR are in many ways both supporting and conflicting. The complex interplay between the actions and responsibilities of the many agencies with interests in the range has led some in the public to challenge the effectiveness of the present land management system. Comments received during scoping criticized the present multiple agency management situation as creating redundancy as well as gaps that compromise the effectiveness of natural and cultural resource management. These challenges directly question whether the interagency administrative relationships spawned by P.L. 99-606 for natural and cultural resource management are appropriate. To address these concerns, three renewal scenarios that address the administrative relationships among agencies with federal surface management responsibilities on the BMGR are proposed for consideration. Scenario C1 would continue the existing management relationships as established by P.L. 99-606, including those established through current MOUs and LOAs. Scenario C2 would re-define these relationships by assigning the Air Force, and possibly the Marine Corps if Scenario A2 proposing a split military reservation is selected, as the primary agency(ies) responsible for surface management within the western and eastern land sections. Scenario C3 proposes that an interagency collaborative management approach be forged. These scenarios are described in detail in the following sections.

2.7.1 Scenario C1: Renew the BMGR Without Changing Agency Resource Management Responsibilities

The administrative responsibilities of federal agencies for the management of natural and cultural resources on a renewed BMGR would not change under Scenario C1 from the conditions

established under P.L. 99-606 (Figure 2-9 and see Table 2-1). The Secretary of the Interior, through the BLM Phoenix and Yuma field offices, would continue to hold the designated responsibility for land management within the western and eastern land sections of the range. The USFWS would continue to administer surface management within the Cabeza Prieta NWR section.

The land management framework established by P.L. 99-606 places the FLPMA as the primary, overall legal guidance for preparing and implementing natural and cultural resource management plans for the eastern and western range land sections. P.L. 99-606 also places restrictions on how these land sections may be used. Primacy is granted to the military mission and the area is closed to all forms of appropriative land use for at least the duration of the land withdrawal. As the designated federal land management agency, the BLM must act through FLPMA regulations in planning and implementing its management actions. The FLPMA would continue to serve as the primary legal guidance for BLM management of the eastern and western land sections under Scenario C1. The BLM completed the Lower Gila South RMP Goldwater Amendment in 1990 to develop specific guidance for management of the BMGR per P.L. 99-606 requirements and FLPMA and NEPA regulations. The Goldwater Amendment would remain in effect under Scenario C1 into the post-range renewal period until such time that the BLM completes an updated resource management plan.

Although P.L. 99-606 provides that the Secretary of the Interior holds the responsibility for managing the eastern and western land sections of the BMGR, this provision does not preclude involvement by the Air Force, Marine Corps, USFWS, or AGFD in natural or cultural resources management (see Figure 2-9). The involvement of the military agencies stems in part from the extent of their training and training support activities on the range and from requirements to plan and conduct these activities in compliance with federal environmental law and regulations. Military agencies also have a responsibility to develop and implement natural and cultural resource management plans for installations under their command. These requirements are derived from the Sikes Act, as amended (P.L. 105-85), which provides that such management plans be prepared for military reservations located on withdrawn lands as well as for properties fully under their jurisdictions. Given the existing responsibility for land management within the BMGR assigned to the DOI, these Sikes Act provisions could potentially prompt planning and management efforts by DoD agencies that are in conflict with the Lower Gila South RMP Goldwater Amendment. Such potential management conflicts were cited during scoping for the draft LEIS as cumbersome, confusing, and redundant.

FIGURE 2-9
11 X 8 ½ B&W

The extent of military use of the BMGR is reviewed in Section 2.2.2 (see also Figure 2-1). This review demonstrates that there are military requirements for nearly all areas of the BMGR but in most locations the principal need is for undeveloped and uninhabited lands which form a safety buffer around areas where hazardous activities are occurring. Although military activities that involve direct physical use of the land surface within these safety buffer areas are rare or may even be limited to the remote chance of an unplanned munitions impact, these safety buffers have two important influences on natural and cultural resources management.

First, as prescribed in P.L. 99-606, appropriative land uses such as livestock grazing and mining, are prohibited because they are incompatible with the safety or controlled access requirements of military training. Many other land uses such as recreation must be curtailed or strictly controlled to ensure public safety and prevent interference with training schedules. These limitations significantly narrow the mix of non-military land use that resource managers must address in contrast to the array of multiple-use issues with which the BLM must usually contend on properties under its jurisdiction that are not withdrawn as military reservations.

Second, safety requirements associated with military activities impose access restrictions that differ for various portions of the BMGR. Access to the eastern section of the range is highly restrictive because of the safety requirements associated with the tactical, manned, and air-to-air firing ranges. Resource managers are allocated access time within these ranges only on a task by task basis. Although Air Force range schedulers arrange the level of access needed when it is required for specific natural or cultural resource management actions, non-urgent matters may not be scheduled for several days. Opportunities for routine management reconnaissance and observation are limited, however, by the pressing demands of the military training schedule.

The western land section is more suitable for selected non-military uses and the corresponding level of management required of the BLM. The difference is access. With the exception of the Moving Sands and Cactus West target complex, BLM managers have access to nearly all of the western section on a routine basis. This access affords these managers the opportunity to become familiar with the natural and cultural resources of the western section, develop and implement management prescriptions, and monitor change. They are also able to readily observe the extent and nature of Marine Corps operations and public use, which allows them to integrate the resultant effects within their land management perspective.

The western section is not different from the eastern section in terms of the types of permissible land use. Military operations are the single dominant land use and appropriative non-military land uses are prohibited by P.L. 99-606. The open access of the western section, however, provides more opportunity for non-appropriative land use and active BLM management. The area is, for example, more readily accessible and used for dispersed public recreation. Although the Marine Corps is responsible for issuing the permits required for legal public entry, the BLM is responsible for managing recreation use and enforcing visitor regulations. The BLM is also actively involved within the western section in implementing management of three areas of critical environmental concern (ACECsXdesignated by the BLM through the Lower Gila South RMP Goldwater Amendment in 1990), a special habitat management area, and the Lechuguilla-Mohawk and Draft Barry Goldwater East habitat management plans.

The Marine Corps also has an important influence on western section land management through its role as the military operations manager. In this capacity, the Marine Corps, through the Range Management Department at MCAS Yuma, is responsible for the environmental survey, assessment, monitoring, and compliance functions that are necessary to support its BMGR operations. These efforts, in turn, provide positive control of military land use and valuable information on natural and cultural resources within the western section.

The Air Force, Marine Corps, BLM, USFWS, and AGFD have recognized the challenges discussed above for natural and cultural resources management that structurally arise from the provisions of P.L. 99-606. In order to promote better coordination of their collective expertise and resources and a more effective long-term focus for their management efforts, these federal agencies and AGFD formally initiated the Barry M. Goldwater Range Interagency Management Committee (also known as the BEC) in March 1998 with the completion of an enabling MOU. The council membership consists of the senior functional manager of each agency. No single agency will serve as the council lead. Rather, the organization, which is intended as a decision-making body for integrating long-term management plans across administrative boundaries, will operate on a consensus basis. Under current existing law, each agency must retain its own authority for its appropriations, personnel, and actions.

Scenario C1 would continue the divisions of management responsibility described in the above sections (Table 2-2). Range renewal under these terms would not preclude the functions of the BEC but each agency would remain individually and independently responsible for its management actions.

2.7.2 Scenario C2: Renew the BMGR and Designate DoD Agencies as the Resource Management Lead

The Air Force would assume the lead responsibility for managing natural and cultural resources and non-military use within the eastern and western range sections under Scenario C2 proposal (see Table 2-2). The Air Force would assume the lead only for the eastern section if Congress also elects to implement Scenario A2 and split administration for the range between the Air Force and Marine Corps. In this event, the Marine Corps would be responsible for managing natural and cultural resources and non-military use within the western section. Natural and cultural resource and non-military use plans would be developed under the auspices of Air Force and Marine Corps Sikes Act regulations. Current DoD policy for management under this Act emphasizes preserving the biodiversity of range lands. Public access to the BMGR would be maintained at levels compatible with military operations and natural and cultural resource

TABLE 2-2			
Agency Responsibilities and Public Access Conditions Under Each Range Renewal Scenario for Administering Natural/Cultural Resource Management			
Agency(ies) with Primary Administrative Responsibilities/Public Access Conditions	Range Renewal Scenario		
	Scenario C1 Continue P.L. 99-606 Management Conditions	Scenario C2 DoD Agencies Assume Lead Resource Management Responsibilities	Scenario C3 Establish a Collaborative Interagency Management Framework
BLM is lead natural/cultural resource management agency for eastern/western range sections. Manage for multiple-use per FLPMA. Goldwater Amendment remains in effect until such time that BLM (unless required by renewal legislation) determines that a resource management plan update is warranted.	M		
Air Force (and Marine Corps if Scenario A2 is implemented) is lead natural/cultural resource and non-military use management agency for the eastern/western range sections. Manage for biodiversity conservation per Air Force policy/Sikes Act. New resource management plan would be required.		M	
Collaborative interagency management of natural/cultural resources is mandated by range renewal legislation. New resource management plan is required. Plan will be prepared under appropriate regulations with all specified cooperating agencies jointly responsible for plan development. Plan will specify proposed divisions of interagency authorities.			M
USFWS continues as surface management jurisdiction for Cabeza Prieta NWR/Wilderness	M	M	M
Arizona Game and Fish Department administers the state's interests in wildlife and habitat management under all scenarios.	M	M	M
Air Force and Marine Corps continue as military operations managers. Appropriate land uses are prohibited. Non-appropriative land use must be compatible with military operations.	M	M	M
Public visitation opportunities are unaffected unless access can be expanded or must be further restricted as a result of changing military operations.	M	M	M
Voluntary BEC can continue to function. Council neither expands or limits the authorities of member agencies. Each agency remains fully responsible for meeting its own legally mandated management requirements.	M	M	

management objectives. A new resource management plan that integrates military operations, non-military land use, and natural and cultural resource management needs would be prepared. Management alternatives for the plan would be addressed through NEPA documentation.

In some ways, the Air Force is in an effective position for managing natural and cultural resources within the eastern land section. Three management advantages can be identified. First, as already noted, human land use within the eastern section is limited almost entirely to military operations. Although a variety of military operations occur, these activities share a common purpose and are under the management control of a single organization, the 56th FW/RMO. In contrast to diversity of land uses found on off-range BLM lands under multiple use management, the land use situation within the eastern range section has a simplified singular focus over which the Air Force can exercise comprehensive management control. Second, the organizational structure of the RMO is designed to facilitate integrated management of military operations and natural and cultural resources. Combined within the RMO under a single point of command are range operations and scheduling, airspace management, and environmental management. This structure places managers with knowledge about range operations and natural and cultural resources in direct contact with the express purpose of integrating their expertise for effective management. Third, the principal job of the natural and cultural resource specialists of the RMO is to support military training operations by performing necessary environmental survey, assessment, monitoring, and compliance functions. Given that military operations are the primary human land use throughout most of the eastern section, the performance of the functions by the RMO, however, constitutes most of the relevant natural and cultural resource management tasks. Left undone by the RMO is required resource management planning and actions under the FLPMA and law enforcement, which must be performed by the BLM. The BLM is also the agency responsible for managing recreation and enforcing visitor regulations within the eastern section. The responsibility of the Air Force to control access to the range, however, assigns that agency with an important recreation management role.

The benefit of Scenario C2 would be that all of the principal functions for managing military and non-military land use and natural and cultural resources within the eastern and western range sections would be integrated under the lead of one agency rather than split among several. Designation of a single agency as the lead land management jurisdiction is by far the norm within the federal system. As noted in Section 2.7.1, the Air Force and Marine Corps are in good positions to assume single agency management responsibility for the eastern and western sections because:

- # these agencies already manage military use of the range and must control all range access in order to protect public safety and prevent interference with military operations
- # the prohibition on all forms of appropriative land use and the necessary primacy of military operations over all other activities establishes simplified land use profiles for the eastern and western sections
- # the Air Force and Marine Corps are already responsible for the environmental survey, assessment, monitoring, and compliance functions needed to support military actions

- # these agencies are well prepared to integrate military operations, non-military land use, and natural and cultural resource management needs within an integrated resource management plan
- # the majority of funding for resource management activities is provided by the Secretary of the Air Force and the Secretary of the Navy

In order to assume lead management roles, the Air Force and Marine Corps would have to provide staffing and resources to meet management requirements currently addressed by the BLM. Management of public recreation and other non-military uses and law enforcement are examples.

2.7.3 Scenario C3: Renew the BMGR and Establish a Collaborative Interagency Management Framework

Scenario C3 proposes that federal interagency collaboration for the management of natural and cultural resources on the BMGR be mandated with the range renewal. The model for the proposed framework for interagency collaboration is the existing BEC, as established through the March 1998 MOU. Federal participants in the collaborative framework would continue to include the Air Force, Marine Corps, BLM, and USFWS, but other federal agencies could become members if their participation would enhance integrated resource management. AGFD would also continue to participate as a full member of the framework. Like the BEC, the structure of the post-renewal framework would be determined through an interagency agreement among the federal and state agency members. Unlike the BEC, the existence of a collaborative management framework, federal participation in it, and an invitation of membership to AGFD would be required, not voluntary. The structure and functions of the post-renewal framework would likely resemble those of the BEC, but the member agencies would retain the authority to mutually amend the interagency agreement as required to ensure that the natural and cultural resources of the BMGR are effectively managed. The framework agreement would, however, meet or support the following requirements, conditions, and functions:

1. Agency members would be limited to those agencies having direct responsibility for lands or resources on the BMGR or agencies which routinely perform activities on the range that affect lands or resources.
2. Member agency representatives to the framework would be the senior functional manager responsible for his/her agency's actions on the BMGR.
3. The framework would not have statutory authority for range resource management, but its member agencies would through the extent of their enabling legislation.

4. Resource management plans, policies, and actions recommended by the interagency framework would have to be consistent with each member agency's legal requirements and authorities.
5. The interagency framework would serve as an executive level conduit for communication about resource management issues, conflicts, and planning on the BMGR, as well as about existing and proposed agency actions that may affect resources with the goals of:
 - a. achieving conflict resolution through open discussion
 - b. promoting well coordinated and consistent resource management
 - c. minimizing redundant management efforts among member agencies and identifying gaps in resource management attention
 - d. capitalizing on the combined expertise, staffing, and other resources of the member agencies
 - e. establishing coordinated and consistent range visitation policies and procedures
 - f. providing better forums for public information about and participation in range management
6. The interagency framework executive council members could draw upon their respective agency staffs for support or to form working groups, teams, partnerships, or committees to address specific management issues or implement actions.
7. The interagency framework executive council would meet at least semiannually.
8. The interagency framework executive council would serve as the central coordinating body for developing a new interagency collaborative management plan for natural and cultural resources on the BMGR.

The idea of using an interagency agreement to foster communication and coordination among the principal agencies using and managing the BMGR is not new. A cooperative agreement among the Air Force, Marine Corps, BLM, USFWS, and AGFD for natural resources management was in effect from 1982 until adoption of the Lower Gila South RMP Goldwater Amendment in 1990. The principal achievement of that cooperative agreement was to sanction and facilitate development of the Luke Air Force Range Natural Resources Management Plan (University of Arizona 1986) by the Air Force. That plan was used extensively by the BLM as a basis for developing the Goldwater Amendment. Since the passage of P.L. 99-606 in 1986, public and agency attention on BMGR management issues and concerns about inadequate interagency coordination has increased markedly. Development of the BEC concept and its establishment in 1998 was in response to this perceived need for increased management communication and coordination. The BEC places greater emphasis on achieving interagency coordination and

collaboration than occurred under the 1980s natural resources cooperative agreement and has great promise for enhancing resource management. The future progress of interagency collaboration under the BEC, however, depends on the continued voluntary participation of its members.

The interagency collaborative management framework proposed by Scenario C3 is a new concept in two respects. First, inclusion of this scenario as a term of the range renewal would ensure continued interagency collaboration, with executive level involvement, as a tool for guiding enhanced and effective natural and cultural resource management. This requirement would help to alleviate concerns that cooperation among BMGR agencies progresses or declines as a function of senior manager interests and fluctuations in agency priorities. Second, implementation of Scenario C3 would trigger an interagency commitment for preparing a collaborative resource management plan for the BMGR. This plan would be prepared to meet the underlying requirements of both the FLPMA and Sikes Act, thus eliminating requirements for military agencies and the BLM to prepare and implement separate, but in many ways parallel, management plans. A further advantage is that interagency collaboration would yield a plan in which military and non-military land uses could be jointly addressed. This integrated approach would provide the best opportunities to ensure that the requirements of the military mission on the BMGR are met while at the same time preserving effective opportunities for conserving natural and cultural resources and accommodating compatible non-military use. The combined resources, expertise, and perspectives of the collaborating agencies together with public participation in the planning process would produce an even-toned plan that is reflective of the varied interests in the range and compatible with each agency's mandates.

In addition to the above planning benefits, a collaborative interagency management framework would offer several other advantages. First among these would be enhanced opportunities to effectively pool the expertise, staffing, and other resources of the Air Force, Marine Corps, BLM, USFWS, and AGFD, as required. The broad spectrum of environmental resources and land and airspace uses found on the BMGR coupled with the diverse issues pertaining to these resources and uses comprise a management challenge that could well exceed the resources of any single agency. Interagency collaboration offers the best chance for agencies to adequately meet these challenges within their respective levels of staffing and budget.

Closely associated with the pooling of agency resources would be opportunities presented by Scenario C3 to increase management efficiency and reduced costs. The type of close interagency coordination that may result from collaborative planning and management could reduce redundant tasks. Close coordination could also allow agencies with favorable capabilities or resources in geographically advantageous locations to assist one another at an overall savings in personnel time or other costs. From a budget planning perspective, collaboration would allow agencies to compare and adjust their relative priorities for future budgets to avoid redundant spending while at the same time ensuring that critical management needs are not overlooked.

Finally, interagency collaborative management would provide important dividends for facilitating public participation in BMGR management. Each of the principal agencies using and managing the range has developed lines of communication with various segments of the public.

Collaboration would give each of the agencies the opportunity to improve their levels of public responsiveness and service by sharing their public participation experience and resources with each other. Likewise, members of the public would find that they could more effectively reach the agencies responsible for managing the issues of their concern because of the improved flow of public participation information among the collaborative agencies.

2.8 ALTERNATIVES CONSIDERED BUT NOT CARRIED FORWARD

Comments received during scoping suggested that the Air Force should give detailed consideration in the LEIS to (1) closing the BMGR and developing a new range in a less environmentally sensitive location or (2) closing the BMGR and transferring the training functions performed at the BMGR to another existing range or ranges that are less environmentally sensitive than the BMGR. These two range closure alternatives were not carried forward for detailed consideration because they do not offer viable opportunities for meeting national defense training needs. During the public involvement process, the Air Force received several requests to include alternatives in the draft LEIS that address how the land and its resources should be managed (for example, managed as a conservation area or, alternatively, managed for increased recreational access). These alternatives were also not carried forward for detailed consideration because they are outside the scope of this draft range renewal LEIS. The USFWS proposed an alternative to eliminate the Cabeza Prieta NWR from the land withdrawal. This alternative was not carried forward because of the DoD's continuing need for these lands in accomplishing the training missions. Details about these proposed alternatives follows.

2.8.1 Eliminated Non-Renewal Alternatives

The evaluations and ultimate rejections of these closure alternatives were based on five criteria that are core training range requirements that the BMGR satisfies completely. These requirements include:

1. *Air Base Infrastructure.* The alternative range must be supported by an air base infrastructure with adequate aircraft parking ramp space, maintenance, and other support facilities.
2. *Training Capabilities and Capacities.* The range must have adequate airspace and underlying range area to accommodate a full spectrum of realistic training activities including live-fire training using air-to-air, air-to-ground, and surface-to-air weapons; training activities within 10 or more subranges simultaneously; and complex, large, force-on-force exercises involving 80 or more aircraft simultaneously. The range infrastructure must include manned and tactical ranges, targets authorized for use with fully armed munitions, electronically instrumented air combat tactics ranges, auxiliary airfields, and deployment areas for ground troops to support air training activities.

3. *Flexibility.* The range must have the flexibility to accommodate internal airspace and military land use reconfigurations needed to support the evolving training requirements of new aircraft, weapons, or tactics.
4. *Flying Weather.* The range must have a climate that generates year-round visual flying weather to support student aircrew training and air-to-ground weapons training.
5. *Full-Service Aircrew Training.* The range must have the training capabilities and capacity to accommodate concentrated student and operational aircrew training programs.

Developing a new range which could meet the above criteria would mean finding a 4,000 square mile land and airspace location within the Southwest close to existing military air bases with the capacity to support the equivalent of about 45 squadrons (800 plus aircraft) on a permanent basis and about 1,200 additional aircraft annually on a deployment basis. Authority would have to be obtained to control all land use and access within this new range to support live-fire weapons training and training that generates aircraft overflight noise. Existing land uses and possibly landowners would likely have to be expelled from the property to make way for the new training activities. Development of the range infrastructure to support Air Force, Navy, Marine Corps, ARNG, and ANG needs would require the construction of manned and tactical ranges, GRMDs-type instrumented air combat tactics ranges, ground support areas, auxiliary airfields, and other range management and support facilities. A typical Air Force base supports three to four squadrons, or about 72 fighter or attack aircraft. At this rate, as many as 11 air bases would be required to support the equivalent of the permanently based aircraft loading within the BMGR region. This existing load is carried by only eight bases within the BMGR in large part because Luke AFB, which is the largest fighter training base in the world, is capable of supporting more than nine squadrons.

No new location could be found that would meet the above criteria for a BMGR replacement. The distribution of existing air bases within the Southwest essentially points to the general BMGR area as the only location where a BMGR-type of range could receive adequate air base support. Although there are large land areas within this region with relatively low levels of existing development, virtually any new range location would infringe on established land uses, national forests, national parks or monuments, federal wildernesses, national wildlife refuges, state parks, or other protected state lands, state trust lands, utilities and ground transportation systems, private properties, wildlife habitat, endangered species, cultural resources, etc. The conflicts that would likely arise regarding attempts to establish new restricted airspace would be no less difficult. In conclusion, there is no evidence that a viable alternative location to the BMGR could be identified, or any promise that such a site would pose fewer environmental constraints and conflicts.

The review of existing ranges to identify a location that could assume BMGR training missions demonstrated findings that essentially nullify this concept as an alternative for detailed consideration. First, there are very few ranges with the land or airspace dimensions to accommodate the diversity of training missions performed on the BMGR or an equivalent capacity to support high tempo, simultaneous, independent operations. The short list includes

NAFR (3,050,000 acres), White Sands Missile Range (2,560,000 acres), and the Utah Test and Training Range (1,728,000 acres). Although both the NAFR and White Sands Missile Range contain adequate land area and airspace to support a BMGR-sized operation, both of these ranges are heavily committed to supporting testing and other training activities. The NAFR is used by the Air Force and the Department of Energy to perform classified testing operations. The NAFR is also important to the Air Force as the site of advanced training programs and exercises that are more or less counterparts to the Navy's "Top Gun" program and the Marine Corps' WTI Course.

The White Sands Missile Range in New Mexico has the reliable flying weather required to support year-round training, but the priority uses at this facility are test, development, and evaluation of military weapons systems. Training missions are flown in the White Sands Missile Range airspace by aircraft from Holloman AFB, New Mexico; however, these missions are accommodated as a secondary priority to test and evaluation activities. There is insufficient unused time in both the NAFR and White Sands Missile Range schedules to accommodate more than a token of the training missions flown at the BMGR without curtailing priority activities at both of these ranges.

The Utah Test and Training Range is currently underutilized and could accommodate some additional training missions. This range is somewhat undersized, however, in terms of accommodating the whole of the BMGR training mission. Weather is also an element of concern at the Utah Test and Training Range as is the availability of air base support. Northwestern Utah has about 20 percent fewer visual flying weather days per year than does the BMGR. Weather imposed delays in flying schedules can become a significant problem for student training programs that must meet expected student intake and graduation rates in order to supply needed qualified aircrews to operational units.

Perhaps the most important deficiency at the Utah Test and Training Range, which is also a factor at NAFR and White Sands Missile Range, is the lack of sufficient air base support capacity. Hill AFB is the only military air base near the Utah Test and Training Range. Mountain Home AFB in Idaho is the next closest. These installations do not have the capacity to support the aircraft and support units associated with the BMGR. NAFR is fairly close to two Air Force bases (Nellis and Edwards) and three Naval air stations (China Lake, Lemoore, and Fallon). The White Sands Missile Range is near Holloman, Cannon, and Kirtland AFBs. Again, however, these installations fall far short of having the capacity to absorb the training operations that are currently dependent on the BMGR.

The above three ranges are the only American installations with the size potential to absorb the BMGR training operations as a whole; assuming that other deficiencies in capacity could be overcome and the existing operations at these ranges could be displaced. The only other course of action available to relocate training operations from the BMGR would be to parcel squadrons out to a whole series of air bases with access to local training ranges of up to about 100,000 acres. This approach may work adequately for some individual operational units although the diversity and quality of the weapons range training may decline from the standard set by the BMGR. Such an approach, however, would be absolutely contrary to one of the core purposes of

the BMGR, which is to provide the entire spectrum of tactical aviation training assets needed to support concentrated centralized aircrew development programs in one location. The BMGR accomplishes this mission with ample capacity to support a number of independent centralized training, including programs that represent:

- # all student aircrew training for the Air Force in the F-16 and A-10 aircraft
- # all ANG student training in the F-16 aircraft
- # half of the attack helicopter training for the ARNG
- # half of the operational aircrew training in the AV-8B for the Marine Corps
- # all of the student and half of the operational aircrew training in the F/A-18 for the Marine Corps

2.8.2 Eliminated Resource Management Alternatives

A number of comments received during the public involvement process called for the inclusion of resource management proposals in the LEIS alternatives. These comments specifically addressed land use designations, public access, and other natural and cultural resource management issues. The Air Force was asked to incorporate these resource management proposals in the draft LEIS and forward them to Congress for action concurrent with the requested BMGR renewal. Resource management proposals received for inclusion as alternatives within the draft LEIS have been eliminated from detailed consideration based on the following three criteria:

1. P.L. 99-606 directs the Secretary of the Air Force to prepare a draft EIS addressing the continuing military need for the BMGR. While the administration (responsible agency) of natural and cultural resource management is addressed in Scenarios C1, C2, and C3, developing recommendations to Congress for specific resource management actions is outside the scope of the LEIS because such actions do not address the continuing military purpose and need for the BMGR. Consequently, developing such recommendations cannot be regarded as either range renewal alternatives or scenarios.
2. An EIS that addresses the purpose of and need for new resource management planning must consider a full range of alternative plans. For example, the EIS could not be limited to managing for conservation if managing for maximum economic development is also a viable alternative. The range of possible land uses might include wilderness, mining, livestock grazing, motorized or other forms of non-wilderness recreation, or agriculture to name a few possibilities. The draft LEIS, which focuses on the proposed renewal of the military land withdrawal, is not an appropriate vehicle to report on the potential consequences of non-military land use alternatives.
3. Neither the Air Force nor BLM could forward recommendations for new resource management of the BMGR to Congress prior to completing the requisite alternative land use assessment cited above in criterion 2. The proper process includes completing an assessment of the appropriateness and environmental effects of a new resource management plan for the BMGR. The development of such a plan following soon after

the renewal of the range is a possibility. The resource management proposals received from the LEIS public involvement processes may be appropriate for consideration at that time. A near-term planning update of the Lower Gila South RMP Goldwater Amendment, which would remain in effect following range renewal if Scenario C1 is implemented, appears likely and may be directed by the renewal legislation. In any event, an update of the Goldwater Amendment would be necessary eventually. Development of new resource management plans following range renewal would be a requirement under Scenarios C2 or C3.

2.8.3 Eliminated Cabeza Prieta NWR Alternative

The USFWS recommended that the Air Force consider an alternative that would exclude the Cabeza Prieta NWR, in whole or in part, from the proposed renewal of the BMGR land withdrawal. The issues that the USFWS raised in proposing this alternative were that:

- # withdrawal of the range may not be the only mechanism available to ensure mutually acceptable (to the Air Force/Marine Corps and USFWS) military use of the airspace overlying the refuge
- # a withdrawal of 822,000 acres of the range may not be the only mechanism available to secure continued access to and use of five GRMDS and TACTS instrument sites within the refuge
- # exclusion of the refuge from the BMGR renewal would not necessarily alter the military purposes for which the DoD needs the range

This recommendation was not carried forward for further consideration because it would not accomplish the primary purpose of preserving training flexibility on the BMGR. Unlike the areas proposed for non-renewal (Section 2.6.2, Scenario B2), the Cabeza Prieta NWR has been and continues to be a major, necessary component of the BMGR.

The Cabeza Prieta NWR land area has served as an essential part of the BMGR since World War II. More than 95 percent of the Cabeza Prieta NWR is within the withdrawn land area of the BMGR and the entire refuge is overlain by restricted airspace designated for military use. Since the range was established, training requirements at the student pilot level have fluctuated many times because of changes in aircraft and weapon systems technology, tactics, or actual wartime experience. One of the most important reasons for renewing the full operational dimensions of the BMGR (including the Cabeza Prieta NWR) is to preserve the invaluable training flexibility that the range has provided throughout its history. The size of its restricted land and airspace is its most critical attribute.

P.L. 99-606 describes the BMGR (including the Cabeza Prieta NWR) as an area for "armament and high-hazard testing... training for aerial gunnery... tactical maneuvering and air support." The law also stipulates that the Cabeza Prieta NWR be "managed pursuant to the National Wildlife Refuge System Administration Act of 1966." These overlapping conservation and defense roles were expanded in 1990 with the passage of the Arizona Desert Wilderness Act

(P.L. 101-628), which designated most of the Cabeza Prieta NWR as a federal wilderness. In P.L. 101-628, Congress struck a balance between recognition and preservation of the wilderness qualities of the Cabeza Prieta NWR and the critical importance of this same area for national defense training. The Act states:

Nothing in this title including the designation as wilderness of lands within the Cabeza Prieta National Wildlife Refuge, shall be construed as—

- (1) precluding or otherwise affecting continued low-level overflights by military aircraft over such refuge or the maintenance of existing associated ground instrumentation, in accordance with any applicable interagency agreements in effect on the date of enactment of this Act; or
- (2) precluding the Secretary of Defense from entering into new or renewed agreements with the Secretary concerning use by military aircraft of airspace over such refuge or the maintenance of existing associated ground instrumentation, consistent with management of the refuge for the purpose for which such refuge was established and in accordance with laws applicable to the National Wildlife Refuge System.

In a 1994 MOU, the Air Force, Marine Corps, and USFWS limited military overflights of the refuge below 1,500 feet AGL to mutually agreed upon corridors. This MOU also placed authorization for aerial gunnery over the refuge in an inactive status for the first time since the inception of the range during World War II. Since 1994 there has been no requirement for the refuge to serve as an active impact area for aerial munitions.

The current need for continued inclusion of the refuge within the BMGR renewal is as a secondary safety buffer area for air-to-ground activities associated with the BMGR ground target areas.

In the future, realistic, multi-axis aircrew training with long-range air-to-ground munitions (such as the JDAM), with the intended impact area on the current tactical ranges in the BMGR, will require continued use of refuge lands as a secondary safety buffer area. Likewise, a need to use the range for realistic surface-to-air missile training may also require that lands on the refuge be used as a secondary safety buffer area.

There is currently an increasing requirement to provide aircrews with nighttime air combat training using night vision goggles with the navigation lights of participating aircraft turned off. Restricted airspace may soon be the only airspace locations below 18,000 feet MSL that the FAA will authorize for this type of training. If so, R-2301W/E would be vital for this training.

Although the use of the Cabeza Prieta NWR for multiple purposes is not always complementary, Congress has in essence established that they are all authorized uses of the same withdrawn public lands. Eliminating the refuge from the BMGR renewal would adversely diminish the national defense military training flexibility. The Cabeza Prieta NWR has been and will continue to be a major component of the BMGR.

2.9 COMPARISON OF THE ALTERNATIVES AND SCENARIOS

A comparison of the alternatives is included in Table 2-3. A comparison of the renewal scenarios is included in Tables 2-4, 2-5, and 2-6. The Air Force has elected to not identify a preferred alternative or scenario, but will do so after considering public input on this draft LEIS.

TABLE 2-3
COMPARISON OF ALTERNATIVES
11 x 17 landscape
3 pages

Table 2-3 page 2

Table 2-3 page 3

**TABLE 2-4
COMPARISON OF MILITARY ADMINISTRATION SCENARIOS (A1 and A2)**

Resource	Scenario A1	Scenario A2
	Renew the BMGR as one military reservation administered by the Air Force	Renew the BMGR as two military reservations administered by the Air Force and the Marine Corps
Airspace and Range Operations	<ul style="list-style-type: none"> • the Air Force would continue to serve as the designated overall administrator for the BMGR • the Air Force would retain jurisdiction and management control over military use on the western land section of the range • the Marine Corps would remain the delegated scheduling agency, principal user (along with the Navy), and manager of its own activities within the western section of the BMGR through letter of agreement with the Air Force (see Appendix C) • the Marine Corps role as the scheduling agency for R-2301W would continue <p>For more details, see Sections 3.3 and 5.2.1 of the draft LEIS.</p>	<ul style="list-style-type: none"> • the Air Force would administer the eastern land section of the BMGR and R-2301E, R-2304, and R-2305 • the Air Force would no longer have jurisdiction or management control over military use on the western land section of the BMGR • the Marine Corps would administer the western land section of the BMGR and R-2301W • the Marine Corps authority for scheduling and management of military activity on the western land section of the BMGR would be designated in the legislation for renewal of the range (not through letter of agreement with the Air Force) <p>For more details, see Section 5.2.1 of the draft LEIS.</p>
Non-military Land and Airspace Use	A split administration of the BMGR between the Air Force and Marine Corps is not expected to affect non-military land and airspace use. For more details, see Section 5.3.1 of the draft LEIS.	
Public Utilities and Ground Transportation	A split administration of the BMGR between the Air Force and Marine Corps is not expected to affect public utilities and ground transportation. For more details, see Section 5.4.1 of the draft LEIS.	
Noise	A split administration of the BMGR between the Air Force and Marine Corps is not expected to have a noise effect. For more details, see Section 5.5.1 of the draft LEIS.	
Public Health and Safety	A split administration of the BMGR between the Air Force and Marine Corps is not expected to affect public health and safety. For more details, see Section 5.6.1 of the draft LEIS.	
Cultural Resources	<ul style="list-style-type: none"> • the Air Force would continue to be required to be a signatory and review and comment on Marine Corps proposed undertakings <p>For more details, see Sections 3.8 and 5.7.1 of the draft LEIS.</p>	<ul style="list-style-type: none"> • the Air Force would no longer be required to review and comment on Marine Corps proposed undertakings on the western land section of the range <p>For more details, see Section 5.7.1 of the draft LEIS.</p>
Socioeconomic Resources	<ul style="list-style-type: none"> • Air Force and Marine Corps administrative responsibilities would remain unchanged; thus, there would be no change in the current socioeconomic effect of the BMGR <p>For more details, see Sections 3.9 and 5.8.1 of the draft LEIS.</p>	<ul style="list-style-type: none"> • would likely require the Marine Corps to increase its expenditures at MCAS Yuma to support its additional administrative responsibilities for the western section of the BMGR <p>For more details, see Section 5.8.1 of the draft LEIS.</p>
Visual Resources	A split administration of the BMGR between the Air Force and Marine Corps is not expected to affect visual resources. For more details, see Section 5.9.1 of the draft LEIS.	
Recreation	A split administration of the BMGR between the Air Force and Marine Corps is not expected to affect recreation. For more details, see Section 5.10.1 of the draft LEIS.	
Hazardous Materials and	<ul style="list-style-type: none"> • to regulatory agencies, the Air Force would continue to be the “owner/operator” of the 	<ul style="list-style-type: none"> • the Marine Corps would become responsible for Marine Corps hazardous materials and waste

**TABLE 2-4
COMPARISON OF MILITARY ADMINISTRATION SCENARIOS (A1 and A2)**

Resource	Scenario A1	Scenario A2
Waste	entire BMGR and would, thus, be ultimately responsible for Marine Corps hazardous materials and waste management activities on the western section of the BMGR For more details, see Sections 3.12 and 5.11.1 of the draft LEIS.	activities on the western section of the BMGR; the Air Force would remain responsible for Air Force hazardous materials and waste activities on the eastern section of the BMGR For more details, see Section 5.11.1 of the draft LEIS.
Earth Resources	A split administration of the BMGR between the Air Force and Marine Corps is not expected to affect earth resources. For more details, see Section 5.12.1 of the draft LEIS.	
Water Resources	A split administration of the BMGR between the Air Force and the Marine Corps is not expected to affect water resources. DoD agencies would retain adjudication claims. For more details, see Section 5.13.1 of the draft LEIS.	
Air Quality	A split administration of the BMGR between the Air Force and Marine Corps is not expected to affect air quality. For more details, see Section 5.14.1 of the draft LEIS.	
Biological Resources	A split administration of the BMGR between the Air Force and Marine Corps is not expected to affect biological resources. For more details, see Section 5.15.1 of the draft LEIS.	
Environmental Justice	A split administration of the BMGR between the Air Force and Marine Corps is not expected to have an environmental justice effect. For more details, see Section 5.16.1. of the draft LEIS.	

TABLE 2-5 COMPARISON OF LAND WITHDRAWAL AREA SCENARIOS (B1 and B2)		
Resource	Scenario B1	Scenario B2
	Renew the BMGR by withdrawing the same land area as the existing reservation	Renew the BMGR by withdrawing a smaller land area than that of the existing reservation
Airspace and Range Operations	A reduction in the area of the BMGR land withdrawal would not be expected to affect airspace and range operations. For more details, see Section 5.2.2 of the draft LEIS.	
Non-military Land and Airspace Use	<ul style="list-style-type: none"> • appropriate land uses would continue to be restricted for BMGR lands in Sand Tank Mountains, Sentinel Plain area, and Ajo Airport area • non-military use compatible with the military use of the lands could continue <p>For more details, see Sections 3.4 and 5.3.2 of the draft LEIS.</p>	<ul style="list-style-type: none"> • in addition to recreation and wildlife and cultural resource protection, new non-military land uses could be considered for non-renewed parcels of land • BLM would manage non-renewed parcels according to existing public land laws and through an interdisciplinary planning effort <p>For more details, see Section 5.3.2 of the draft LEIS.</p>
Public Utilities and Ground Transportation	<ul style="list-style-type: none"> • new utility or transportation corridors would likely be located within designated corridors <p>For more details, see Sections 3.5 and 5.4.2 of the draft LEIS.</p>	<ul style="list-style-type: none"> • depending on determinations regarding future land use on non-renewed parcels of land, new utility or transportation corridors could be permitted in these areas <p>For more details, see Section 5.4.2 of the draft LEIS.</p>
Noise	A reduction in the BMGR land withdrawal area would not be expected to have an effect on noise. For more details, see Section 5.5.2 of the draft LEIS.	
Public Health and Safety	<ul style="list-style-type: none"> • no decontamination efforts would be likely to occur in the Sand Tank Mountains area, Sentinel Plain area or in the area of the Ajo Airport <p>For more details, see Sections 3.7 and 5.6.2 of the draft LEIS.</p>	<ul style="list-style-type: none"> • non-renewed lands would have to be evaluated for levels of contamination from explosive ordnance and toxic or hazardous materials before determining future use <p>For more details, see Section 5.6.2 of the draft LEIS.</p>
Cultural Resources	<ul style="list-style-type: none"> • cultural resources in the Sand Tank Mountains area, Sentinel Plain area, and Ajo Airport area would continue to be potentially affected by relatively low levels of recreation use <p>For more details, see Sections 3.8 and 5.7.2 of the draft LEIS.</p>	<ul style="list-style-type: none"> • decontamination efforts in non-renewed lands could potentially disturb cultural resources to a greater extent than the current condition • increase of public and private use of non-renewed lands could potentially disturb cultural resources <p>For more details, see Section 5.7.2 of the draft LEIS.</p>
Socioeconomic Resources	<ul style="list-style-type: none"> • appropriate land uses would continue to be restricted for BMGR lands in the Sand Tank Mountains area, Sentinel Plain area, and in the area of the Ajo Airport <p>For more details, see Sections 3.9 and 5.8.2 of the draft LEIS.</p>	<ul style="list-style-type: none"> • in the long term, potential appropriate uses of non-renewed lands could provide economic opportunity <p>For more details, see Section 5.8.2 of the draft LEIS.</p>
Visual Resources	<ul style="list-style-type: none"> • the visual resources of the Sand Tank 	<ul style="list-style-type: none"> • short-term visual impacts could occur as a

TABLE 2-5 COMPARISON OF LAND WITHDRAWAL AREA SCENARIOS (B1 and B2)		
Resource	Scenario B1	Scenario B2
	<p>Mountains area, Sentinel Plain area, and Ajo Airport area would continue to be largely unaffected by military activities and minimally affected non-military land use such as recreation</p> <p>For more details, see Sections 3.10 and 5.9.2 of the draft LEIS.</p>	<p>result of decontamination efforts</p> <ul style="list-style-type: none"> • long-term visual impacts could occur if non-renewed parcels of land are opened to mining, livestock grazing, or intensive recreation <p>For more details, see Section 5.9.2 of the draft LEIS.</p>
Recreation	<ul style="list-style-type: none"> • the Air Force would continue to provide recreational access to the Sand Tank Mountains area • recreation access to the Sentinel Plain area could continue to occur when it did not interfere with military training <p>For more details, see Sections 3.11 and 5.10.2 of the draft LEIS.</p>	<ul style="list-style-type: none"> • the Air Force would no longer manage recreational access to the non-renewed lands • future land management could call for the same level of recreation, more intensive recreation, or discontinued recreation in non-renewed parcels of land <p>For more details, see Section 5.10.2 of the draft LEIS.</p>
Hazardous Materials and Waste	<ul style="list-style-type: none"> • no decontamination efforts would be likely to occur in the Sand Tank Mountains area, Sentinel Plain area, or in the Ajo Airport area <p>For more details, see Sections 3.12 and 5.11.2 of the draft LEIS.</p>	<ul style="list-style-type: none"> • the extent of contamination of non-renewed lands with explosive, toxic, and hazardous waste would have to be determined and a decontamination plan would have to be developed <p>For more details, see Section 5.11.2 of the draft LEIS.</p>
Earth Resources	<ul style="list-style-type: none"> • all lands in the existing withdrawal would continue to be precluded from mineral or energy resource exploration or development; minerals would be unaffected for potential future use • military operations would continue to have negligible or no earth resources effects (including no accelerated soil erosion) in the Sand Tank Mountains, Sentinel Plain, and Ajo Airport areas <p>For more details, see Sections 3.14 and 5.12.2 of the draft LEIS.</p>	<ul style="list-style-type: none"> • depending on economic viability and future land management plans developed by the BLM, exploration and development of mineral or energy resources may potentially occur in the Sand Tank Mountains or Sentinel Plain areas (no potential mineral or energy resources have been identified in the Ajo Airport area) • non-renewed lands would be evaluated for levels of contamination in soil and rock resulting from unexploded ordnance or other hazardous materials used by DoD; a decontamination plan would be developed and implemented, if determined necessary <p>For more details, see Section 5.12.2 of the draft LEIS.</p>
Water Resources	<ul style="list-style-type: none"> • the Air Force would retain adjudication claims for water rights within the Sand Tank Mountains and Sentinel Plain areas 	<ul style="list-style-type: none"> • adjudication claims for water rights within the Sand Tank Mountains and Sentinel Plain areas would be reassigned to the BLM

TABLE 2-5 COMPARISON OF LAND WITHDRAWAL AREA SCENARIOS (B1 and B2)		
Resource	Scenario B1	Scenario B2
	(no DoD adjudication claims exist in the Ajo Airport area) For more details, see Sections 3.15 and 5.13.2 of the draft LEIS.	<ul style="list-style-type: none"> non-renewed lands would be evaluated for levels of contamination in surface water and groundwater; a decontamination plan would be developed and implemented, if determined necessary For more details, see Section 5.13.2 of the draft LEIS.
Air Quality	A reduction in the BMGR land withdrawal area would not be expected to have an effect on air quality. For more details, see Section 5.14.2 of the draft LEIS.	
Biological Resources	<ul style="list-style-type: none"> biological resources in the Sand Tank Mountains area, Sentinel Plain area, and Ajo airport area would continue to be potentially affected by relatively low levels of recreation use For more details, see Sections 3.17 and 5.15.2 of the draft LEIS.	<ul style="list-style-type: none"> decontamination efforts in non-renewed lands could potentially disturb biological resources potential future uses (such as mining and livestock grazing) of non-renewed lands could potentially negatively affect valuable biological resources, most notably in the Sand Tank Mountains area For more details, see Section 5.15.2 of the draft LEIS.
Environmental Justice	A reduction in the BMGR land withdrawal area would not be expected to have an environmental justice effect. For more details, see Section 5.16 of the draft LEIS.	

TABLE 2-6 COMPARISON OF ADMINISTRATION OF LAND AND CULTURAL RESOURCE MANAGEMENT SCENARIOS (C1, C2)		TABLE 2-6 COMPARISON OF ADMINISTRATION OF LAND AND CULTURAL RESOURCE MANAGEMENT SCENARIOS (C1, C2)	
Scenario C1	Resource	Scenario C2	Scenario C1
natural and cultural resources of a renewed BMGR by redefining the agency responsibilities and interagency agreements in effect under Public Law 99-606.	Manage the natural and cultural resources of a renewed BMGR by redefining the responsibilities of DoD and DOI agencies. DoD agencies would assume responsibility for managing natural and cultural resources outside of the Cabeza Prieta NWR and the BLM would assume a management advisory role for these same lands.		Manage the natural and cultural resources of a renewed BMGR through a collaborative interagency framework.
the military would be included in any new resource management planning process, the process would likely be primarily responsible for plan development; airspace and range operations would be as closely integrated with other requirements as is the case under Scenarios C2 and C3. For more details, see Sections 3.3 and 5.4.3 of the draft LEIS.	<ul style="list-style-type: none"> new resource management planning would integrate airspace and range operations with other requirements For more details, see Section 5.2.3 of the draft LEIS.	<ul style="list-style-type: none"> new collaborative management planning would integrate airspace and range operations with other requirements For more details, see Section 5.2.3 of the draft LEIS.	<ul style="list-style-type: none"> DoD would assume the role of primary applicant for transportation and utility For more details, see Section 5.4.3 of the draft LEIS.
Public Health and Safety	DoD would become the land manager of the eastern and western portions of the BMGR. For more details, see Section 5.6.3 of the draft LEIS.	No public health and safety effects would result from the administration of BMGR natural and cultural resources.	DoD would become the land manager of the eastern and western portions of the BMGR. For more details, see Section 5.6.3 of the draft LEIS.

<p>TABLE 2-6 COMPARISON OF ADMINISTRATION OF NATURAL AND CULTURAL RESOURCE MANAGEMENT SCENARIOS (C1, C2, AND C3)</p>		
Scenario C1	Scenario C2	Scenario C3
<p>Administration of cultural resource management would remain complicated with a number of agencies involved. There is potential for redundancy of responsibilities for cultural resources to be identified in some cases. For more details, see Sections 3.8 and 3.9 of the draft LEIS.</p>	<ul style="list-style-type: none"> having a single administrator for given land areas would help ensure that administrative confusion does not impede proactive cultural resource management <p>For more details, see Section 5.7.3 of the draft LEIS.</p>	<p>An inventory of the environmental resources in the region and airspace (see Figure 3-2) compiled from many sources, including published and unpublished literature, agency reports, public meetings, and field reconnaissance. Appendix D includes the sources of public and agency input and Appendix I includes a list of references. resource specialists could be pooled</p> <p>Based on the available data, this chapter describes the BMGR environments that may be affected by the renewal or non-renewal of the range. For some resources, the affected environment is primarily limited to the lands within the existing BMGR boundary. For other resources, the region influenced by the range includes immediately adjacent lands, airspace associated with aircrew training on the BMGR, or even the installations from which the aircraft originate.</p>
<p>the administration of BMGR natural and cultural resource management would not affect socioeconomic resources. For more details, see Section 5.8.3 of the draft LEIS.</p>	<p>DoD would manage visual resources outside of the Cabeza Prieta NWR; BLM would likely serve in an advisory role to DoD</p> <p>For more details, see Section 5.9.3 of the draft LEIS.</p>	<p>environment is primarily limited to the lands within the existing BMGR boundary. For other resources, the region influenced by the range includes immediately adjacent lands, airspace associated with aircrew training on the BMGR, or even the installations from which the aircraft originate.</p>
<p>visual materials and waste effects would result from a change in the administration of BMGR natural and cultural resource management. For more details, see Section 5.11.3 of the draft LEIS.</p>	<p>the administration of BMGR natural and cultural resource management would not affect water resources. For more details, see Section 5.12.3 of the draft LEIS.</p>	<p>This chapter first addresses the human environment, which includes those resources most influenced by man. This is followed by an overview of the natural environment, which includes earth, water, air, and biological resources. Environmental justice is addressed last as the analysis (addressed in Chapter 4.0) is based on the findings of the historical understanding of significant adverse effects on other resources.</p>
<p>the administration of BMGR natural and cultural resource management would not affect air quality. For more details, see Section 5.13.3 of the draft LEIS.</p>	<p>the administration of BMGR natural and cultural resource management would not affect air quality. For more details, see Section 5.13.3 of the draft LEIS.</p>	<p>air, and biological resources. Environmental justice is addressed last as the analysis (addressed in Chapter 4.0) is based on the findings of the historical understanding of significant adverse effects on other resources.</p>
<p>Mapping biological resources and identifying agency responsibilities would continue to be complicated as confusion as to which agency is responsible for the effects of biological resource management resulting in the potential for redundancies or omissions. For more details, see Sections 3.17 and 3.18 of the draft LEIS.</p>	<ul style="list-style-type: none"> single agency management would end the confusion of current multiple agency structure DoD is in the position to incorporate military operations as an integrated land use component in natural resource and habitat management plans <p>For more details, see Section 5.15.3 of the draft LEIS.</p>	<ul style="list-style-type: none"> the expertise and resources of multiple agencies are pooled the historical understanding of significant adverse effects on other resources <p>involvement of the agencies</p> <p>For more details, see Section 5.15.3 of the draft LEIS.</p>
<p>Environmental justice effects would result from a change in the administration of BMGR natural and cultural resource management. For more details, see Section 5.16 of the draft LEIS.</p>	<p>Environmental justice effects would result from a change in the administration of BMGR natural and cultural resource management. For more details, see Section 5.16 of the draft LEIS.</p>	<p>Environmental justice effects would result from a change in the administration of BMGR natural and cultural resource management. For more details, see Section 5.16 of the draft LEIS.</p>

3.0 AFFECTED ENVIRONMENT

3.1 INTRODUCTION

3.2 HUMAN ENVIRONMENT OVERVIEW

Although the BMGR is presently uninhabited, major components of the range environment are connected to and interrelated with past and present human uses. Evidence suggests that the earliest humans, hunters of large mammals such as mammoths, arrived in the range area around 11,000 years ago and possibly earlier. Within the last 1,500 years, the range area has witnessed use by Hohokam, Patayan, and possibly Trincheras peoples whose descendants include contemporary Native American groups.

From the 1500s to the 1700s, European missionaries and explorers crossed the BMGR region along north/south routes between present day Mexico and the United

States and along east/west routes connecting Tucson and Yuma. Beginning with the discovery of gold in California in 1849, hundreds of American pioneers endured wagon, foot, and horseback travel through the range to seek their fortunes in the gold fields or pursue other economic opportunities on the west coast. In the late 1800s and early 1900s, the discovery of ore deposits within the present range led to an increase in prospecting and mining activities on the range. At the same time, some cattle ranchers settled in the area and began grazing livestock on the sparse vegetation of portions of the range. Some miners and ranchers managed to sustain some type of living, but most moved on after a short period. These meager activities continued at a variable pace until just before the United

State's entry into World War II, when the BMGR was established and reserved for military use. Civilian economic uses and development have been excluded from the BMGR ever since.

The present day human environment of the BMGR continues to be dominated by military land and airspace use. Pilots are trained in air-to-air, air-to-ground, and surface-to-air combat on several different types of training ranges. Effective aircrew training necessarily produces noise as well as health and safety concerns from the use of aircraft and air-to-air and air-to-ground weapons. Aircraft use also subjects the BMGR region to varying levels of overflight noise. By law, the compatibility of non-military uses of the range must be evaluated relative to the requirements of the overriding military mission. Permitted non-military use must be compatible with the military mission. Present day non-military land uses of the range include surveillance of the international border, transportation and utility rights-of-way, recreation, and natural and cultural resource management. The Cabeza Prieta NWR comprises nearly one-third of the BMGR lands. The airspace over the refuge is used for aircrew training; however, military land use within the refuge is limited to five remotely located electronic, unmanned, instrument sites. The use of BMGR airspace by civil aviation is generally prohibited because of the hazards that military training activities present.

The greater BMGR region is increasingly active as a center for social and economic development. With the passage of the North American Free Trade Agreement (NAFTA) and the establishment of the North American Development Bank, an increased amount of attention has been placed on the opportunities in both the United States and Mexico for continued regional economic growth. Military installations that rely on the range to support some component of their training mission contribute to the regional economy through direct employment and expenditures in major growing metropolitan communities such as Phoenix, Tucson, and Yuma.

The BMGR region continues to be an important crossroads for travel between the United States and Mexico and between Arizona and California. The transportation corridors of today consist of two major east/west routes—Interstate 8 to the north of the range and Mexican Highway 2 to the south of the range—and two major north/south routes—State Route 85 through the east side of the range and U.S. Route 95 to the west of the range. A transmission line and a railroad spur line serving Ajo and the Ajo mining complex are located within the State Route 85 right-of-way, which passes through the range. Other major utilities such as railroads, transmission lines, pipelines, and irrigation canals serving the growing populations of the region are located east, west, north, and south of the range.

This Draft LEIS attempts to account for the complex, multidimensional, and interrelated nature of the human environment while also describing each component of it. The components of the human environment examined in this section of the Draft LEIS include military land and airspace use, civilian land and airspace use, public utilities and ground transportation, noise, health and safety, cultural resources, socioeconomic resources, visual resources, recreation, hazardous substances, and environmental justice.

3.3 AIRSPACE AND RANGE OPERATIONS

3.3.1 Airspace Structure

The airspace and land area requirements of the 10 live-fire ranges and the Goldwater Range Measurement and Debriefing System (GRMDS) and Tactical Aircrew Combat Training System (TACTS) ranges dictate the overall airspace use patterns of the BMGR and its land use outside of the Cabeza Prieta NWR. Each of these 12 subranges is assigned a block of airspace configured to contain the flight maneuvers and any live-fire weapons use that are necessary for realistic training and provide safe separation from aircraft or live-fire activities that may be occurring in an adjacent subrange (see Figure 1-2 including the airspace cross-sections). For example, an aircraft maneuvering to perform a loft attack³⁴ on a ground target may need airspace vertically up to 24,000 feet MSL³⁵ and can require up to 7 NM horizontally to fly the loft pattern and accommodate the bomb trajectory. Additional horizontal airspace can be required if the training mission involves long lead-ins to the loft pattern. Accordingly, the horizontal and vertical airspace dimensions of live-fire ranges must be configured to provide room for authorized flight maneuvers and weapons trajectories. Live-fire ranges also require an underlying restricted land area that corresponds to the potential danger zone associated with ordnance use (see Figure 2-2).

Separate blocks of vertical and horizontal airspace are defined for the GRMDS and TACTS ranges. Although both of these ranges require electronic instrument stations widely dispersed on the ground, no land areas are reserved for these subranges because no ordnance is released during GRMDS or TACTS operations.

Air Force Airspace Structure

All of the airspace and land area requirements of the live-fire ranges and the airspace requirements of the GRMDS and TACTS ranges fit within the restricted airspace of the BMGR (see Figure 1-2). On the Air Force side, the four manned ranges, three tactical ranges, air-to-air firing range, and air-to-air GRMDS range produce a close fit that maximizes the use of the available land and airspace.

³⁴ To perform a loft attack, an aircrew makes a high-speed run at the target and then pulls up abruptly and releases the bomb while climbing. The aircraft's momentum is imparted to the bomb, which continues forward and initially upward in a ballistic trajectory that is intended to lead to the target. This tactic allows the aircrew to remain farther away from the target and its defensive fire.

³⁵ In aviation terminology, altitudes of 18,000 feet and above are referred to as Flight Levels (FL) and are stated in three digits that represent hundreds of feet. For example, FL180 is 18,000 feet and FL330 is 33,000 feet. FL altitudes are measured by setting a barometric altimeter to a standard atmospheric pressure of 29.92 inches of mercury regardless of the local atmospheric pressure. As a result, FL altitudes vary somewhat, in contrast to MSL altitudes, as atmospheric pressure changes. The advantage of the FL system is that all aircraft at a given FL will follow the same atmospheric pressure surface over the long distances typically flown at high altitude and will, thus, retain their relative vertical separations. For simplicity, altitudes are stated in this report in feet MSL unless otherwise noted.

The multiplicity of weapons ranges is ideally suited for student aircrew training. The multiple examples of the manned and tactical (TAC) ranges serve as classrooms in which large numbers of student aircrews receive the volume of training needed to become competent in each type of weapons delivery tactic. Although the manned ranges are highly standardized and the TAC ranges are designed to share similar features that provide interchangeable levels of training, each individual range has its own look imparted by its setting within the diverse terrain of the BMGR. These differences plus target layout differences within the TAC ranges keep the training challenges fresh and the instructional merit of each training sortie high.

The close fit of the Air Force subranges within R-2301E, R-2304, and R-2305 does not compromise air safety. Effective procedures are in place to prevent conflicts between traffic operating independently within the individual ranges. The substructure of these three restricted areas has consistently met the four basic functions of productive training airspace including:

- # provide adequate airspace for the training activities
- # protect the safety of non-participating air traffic
- # protect the safety of the participating aircrews
- # prevent non-participants from interrupting training activities

Manned Ranges

Manned ranges are used to teach the fundamental mechanics of air-to-ground bombing, strafing, and rocketry. Aircrews fly prescribed patterns to practice a variety of attack techniques against a standardized target layout (Figure 3-1).

An airspace cylinder extending from the surface to 24,000 feet MSL within a 4 NM radius of the target complex at each manned range is required to accommodate aircraft maneuvers and weapons delivery (see Figures 1-2 and 3-1). Outside of the target airspace cylinder, aircraft within prescribed manned range patterns fly within an airspace extension out to 15 NM and from the surface to 8,000 feet MSL.

FIGURE 3-1
TYPICAL MANNED RANGE SURFACE LAYOUT
8 ½ x 11 b/w

TAC Ranges

TAC ranges are used to teach aircrews to apply the air-to-ground bombing, strafing, and rocketry fundamentals learned on the manned ranges against targets that have been constructed to simulate a realistic battlefield. The airspace reserved for each TAC range is large enough to accommodate realistic avenues of attack and escape for each target (see Figure 1-2).

The airspace reserved for East TAC training operations extends beyond the BMGR land boundary but does not exceed the limits of restricted airspace R-2304. Air-to-ground training missions in East TAC are conducted so that all potential ordnance impact areas are within the BMGR land boundary (see Figure 2-1). However, the East TAC targeted impact areas, where more than 99 percent of the delivered munitions strike, are closely clustered around the individual targets, generally within one or two thousand feet of the edge of the simulated target.

The standard airspace reserved for North and South TAC ranges coincide with the potential impact areas of these ranges (see Figure 1-2). Additional airspace areas, designated air-to-air B and C, are assigned to each of these ranges when required. Air-to-air B can be reserved for North TAC operations and air-to-air C can be reserved to support South TAC operations. These airspace extensions give aircrews room to circulate through several attack cycles.

Air-to-air C extends over the Cabeza Prieta NWR. All aircraft are required to remain at or above 1,500 feet AGL while over the refuge. Aircrews usually circulate in a counter clockwise direction within the combined South TAC and air-to-air C airspace. Attack runs are typically made to the north starting over the Cabeza Prieta NWR. Aircrews must plan their attacks to remain above 1,500 feet AGL until they are north of the refuge.

Air-to-Air Range

The primary air-to-air firing range occupies a location used for aerial gunnery training since at least the 1960s (see Figure 1-2). The primary air-to-air firing range extended east to the western border of North and South TAC ranges until 1994. At that time it was reduced to its present size to provide room for air-to-air B and air-to-air C, which are activated by North and South TAC users to provide additional maneuvering area. The air-to-air firing range does not include developed facilities but does require an underlying ground impact area for expended cannon munitions and tow target debris (see Figure 2-1).

An inactive alternate air-to-air firing range is designated over the Cabeza Prieta NWR (see Figure 1-2). The Air Force must give the USFWS 60 days of notice prior to activating this range for use. The Air Force requires an additional 30 days of notice from the user for internal scheduling procedures. Thus, the alternate firing area has ceased to be available as an alternate firing location that can be used spontaneously to avoid mission aborts because of the weather in the primary firing area. Future activation of the alternate firing area does not seem likely unless there is a sharp increase in the requirement for aerial gunnery training and potential weather aborts could no longer be absorbed in the training schedule.

The GRMDS range supports Air Combat Tactics (ACT) training within R-2301E. The existing GRMDS includes seven Tracking and Instrumentation Subsystem (TIS) stations at small remote sites in the eastern section and in the Cabeza Prieta NWR. An upgrade of the GRMDS is underway that will place five additional TIS stations within the eastern section of the range and 15 in off-range locations. Currently, GRMDS coverage is limited to air combat tactics maneuvers flown in the air-to-air complex within R-2301E. The expanded system will project coverage into R-2304; R-2305; and the Sells, Ruby, and Fuzzy Military Operations Areas (MOAs). The GRMDS is used principally to facilitate student training sorties, and is limited to air-to-air engagements.

The lateral boundaries of the air-to-air range, in which GRMDS operations are performed, is coincident with the R-2301E airspace. When active, the airspace reserved for North TAC, South TAC, and Ranges 1, 2, and 3 are excluded from the air-to-air range (see Figure 1-2).

The R-2301E airspace is authorized for unrestricted supersonic operations above 5,000 feet MSL except over the manned ranges where the supersonic floor is at 10,000 feet MSL. Supersonic flight is used for some aspects of air combat maneuvers. However, because maneuverability decreases with increasing supersonic airspeeds, most air-to-air combat maneuvers are performed at high subsonic airspeeds. Supersonic flight is not a part of air-to-ground weapons training.

Military Training Routes

A complement of 14 Military Training Routes (MTRs) provide access to the manned and TAC ranges for low-level flight training (see Figure 1-2). The routes start near Luke AFB, Davis-Monthan AFB, or the Arizona Air National Guard (ANG) Base so that training aircrews can access the routes directly without consuming excess fuel and training flight time enroute to the MTR (see Figure 1-4). Most of the segments within these 14 MTRs have a floor of 500 feet AGL, but some have floors as low as 100 or 300 feet AGL. A few segments have floors above 500 feet AGL because of terrain or land use constraints. Most of the aircrews using these MTRs are students and are restricted to an altitude of no lower than 500 feet AGL on all segments. Instructor pilots or qualified aircrews from operational units may fly at lower altitudes within approved segments to meet their training requirements.

The purpose of MTRs is to provide low-level airspace corridors within which aircrews can develop and maintain the skills necessary for terrain following flight and navigation. Low-level flight allows an aircrew to use terrain to mask their approach to a target from detection by ground-based radars.

Auxiliary Airfields

Auxiliary airfields within the eastern section of the BMGR include Gila Bend Air Force Auxiliary Field (AFAF), AUX-6, and Stoval Airfield (see Figure 1-2). Gila Bend AFAF supports

some fixed-wing aircraft and helicopter training operations. Gila Bend AFAF also serves as an emergency recovery airfield for aircraft that experience malfunctions or damage while operating on the BMGR. AUX-6 and Stoval are both unmaintained World War II era airfields that are used as staging areas and forward arming and refueling points for helicopter operations. The Marine Corps also conducts limited C-130 operations at Stoval during some Weapons Tactics Instructor (WTI) courses.

Aerial Refueling Route

An aerial refueling (AR) route designated AR-647 is located within R-2301E and the Sells MOA/Air Traffic Control Assigned Airspace (ATCAA) (see Figure 1-2). Authorized refueling altitudes include 10,000 feet MSL to 29,000 feet MSL. AR-647 is normally available only at night because other training missions are assigned priority in R-2310E and the Sells MOA/ATCAA.

Buffer Zone

The buffer zone is that airspace from the surface to 80,000 feet MSL that lies within 2.5 NM on either side of the boundary between R-2301W and R-2301E. The buffer zone is in effect whenever R-2301W and R-2301E are scheduled concurrently by independent users. No aircraft may penetrate the buffer zone unless the operator has scheduled both R-2301W and R-2301E.

Ajo Aviation Corridor

A corridor for general aviation operations and air evacuation missions has been designated through R-2301E and R-2305. This corridor extends from the Ajo Airport to Gila Bend AFAF over State Route 85 (see Figure 1-2). Aircraft using this corridor must operate under VFR; remain over the highway; maintain 500 feet AGL during the day and 1,000 feet AGL at night; and establish radio communications with BMGR Range Operations for flights from the south, and with Gila Bend AFAF control tower for flights from the north.

Marine Corps Airspace Structure

The R-2301W airspace structure on the Marine Corps side of the BMGR is partitioned into four subranges: the Yuma TACTS Range, Moving Sands Target Complex, Cactus West Target Complex, and AUX-2 (see Figure 1-2). The R-2301W airspace is used principally for training operational (i.e., combat ready) units of the Marine Corps and Navy. An aggressor squadron (Marine Fighter Training Squadron - 401 or VMFT-401) is stationed at MCAS Yuma to challenge operational units by playing the role of enemy aircraft during aerial combat training missions. VMFT-401 flies the F-5 aircraft.

Yuma TACTS Range

The Yuma TACTS Range airspace is generally regarded as including the R-2301W airspace extending from 200 feet AGL to 80,000 feet MSL between the R-2301W/E buffer zone and the Gila and Tinajas Altas mountains, excluding the airspace below 1,500 feet AGL overlying the Cabeza Prieta NWR and below 3,000 feet MSL north of the BMGR surface boundary (see Figure 1-2). The R-2301W airspace west of the Gila and Tinajas Altas mountains is reserved for the Moving Sands and Cactus West target complex from the surface to 16,000 feet MSL for standard operations and to 21,000 feet MSL when the high block of airspace is also activated over the target complex. The R-2301W airspace above 16,000 feet MSL or 21,000 feet MSL, whichever is active, is incorporated in the TACTS Range. The TACTS is split into low and high blocks at 5,000 feet MSL for the airspace east of the Gila and Tinajas Altas mountains.

Supersonic flight is authorized within R-2301W south of a directional heading that runs roughly from the northwest corner of the BMGR through the northwest corner of the Cabeza Prieta NWR and east of the Moving Sands target location to the buffer zone (see Figure 1-2). Aircraft going supersonic must have a heading of between 110 and 260 degrees magnetic. No altitude restrictions are imposed other than above 1,500 feet AGL over the Cabeza Prieta NWR. Effectively, however, supersonic flight below 5,000 feet MSL does not occur. The supersonic flight limitations for R-2301W are in place to reduce sonic boom effects on the Foothills community along Interstate 8 east of Yuma and in the Wellton-Tacna area.

Moving Sands and Cactus West Targets

The Moving Sands and Cactus West targets serve the same functions as the Air Force manned ranges. Aircrews use the standardized Moving Sands and Cactus West targets to practice the mechanics of bombing and strafing. Moving Sands and Cactus West are scheduled independently. Cactus West traffic must overfly AUX-2 at a minimum of 3,500 feet AGL to avoid conflicts with traffic at the auxiliary field.

AUX-2

AUX-2 is located just inside the western R-2301W boundary (see Figure 1-2). The AUX-2 standard operating area for military traffic extends horizontally for a 2 NM radius and from the surface to 1,200 feet AGL. The original east-west oriented runway of AUX-2 has been redeveloped 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 and taking-off of a LHA ship. Although AUX-2 is an active outlying military airfield, civil aircrews from outside the local area may not be aware of it because it is not depicted on the Phoenix VFR sectional chart. Military aircrews are cautioned to expect civil air traffic immediately west of AUX-2.

3.3.2 BMGR Training Operations

During FY 1996, a total of 72,870 sorties were flown in the BMGR airspace by 44 types of aircraft (Table 3-1). Most of these sorties were flown by the regular BMGR users identified in Table 1-2 in the 12 aircraft types also listed. An accounting of all aircraft types identified as scheduled BMGR users during 1996 includes most military aircraft types in the U.S. inventory as well as some civil aircraft types (Table 3-2). The identities of all civil aircraft users have not been determined but the U.S. Border Patrol, USFWS, Arizona Game & Fish Department (AGFD), and Civil Air Patrol are among these users.

TABLE 3-1				
FY 1996 BMGR AIRSPACE USE				
Use Category	R-2301W	R-2301E	R-2304	R-2305
Annual Sorties	10,975	52,480	7,128	2,287
Days Scheduled	325	292	234	170
Days Activated	325	292	234	170
Days Used	325	292	234	170
Annual Use Rate by Days ^a	.89	.80	.64	.46
Hours Scheduled	2,442	3,567	2,453	1,085
Hours Activated	2,442	3,567	2,422	1,081
Hours Used	2,231	3,567	2,422	1,081
Annual Use Rate by Hours ^b	.25	.41	.28	.12
Hours Released to FAA	6,320	5,193	6,307	7,675
Weekdays Not Activated	34	5	47	95
Weekend Days/Holidays Not Activated	7	69	85	101
a 1996 Annual Use Rate by Days = (1996 was a leap year)	$\frac{\text{Days Used}}{366 \text{ days/year}}$			
b Annual Use Rate by Hours = (leap years have 8,784 hours)	$\frac{\text{Hours Used}}{8,784 \text{ hours/year}}$			

TABLE 3-2
11 x 82

The volume of training performed at the BMGR has varied considerably over the years. Over the last 10 years of record, the total annual sortie rate for the range has varied from a low of 58,056 to a high of 98,785 (Figure 3-2). This type of variable use pattern is not unusual for a major range like the BMGR. Although use in 1996 was up somewhat from the levels of recent years, airspace/range managers at Luke AFB, Davis-Monthan AFB, and MCAS Yuma expect use to be fairly stable into the foreseeable future.

The BMGR has the capacity to absorb sharp increases in use without triggering the need for the sudden development of additional subranges or other facilities. The subrange and target infrastructure has remained stable with an inventory of four manned ranges, three tactical ranges, and an air-to-air gunnery range on the Air Force side since the mid-1960s. The TACTS Range and two scored air-to-ground target complexes (currently Moving Sands and Cactus West) have been the predominant features in place on the Marine Corps side since the 1960s.

While flexible, there are limitations on the BMGR's ability to accommodate potential users. At high training rates all aircrews have to yield training time to accommodate others. Too many training time trade-offs begin to compromise training standards. The BMGR has a substantial capacity to meet surge training needs effectively.

Air Force Operations

An extensive spectrum of flight training activities can be performed within the BMGR (Table 3-3). The facilities are present to support the entire training syllabus for the tactical fighter or attack aircrew.

Manned Range Operations

For student aircrews with no prior experience, the BMGR manned ranges are ideal starting points to learn the mechanics of bombing and strafing in frontline combat aircraft such as the F-16 and A-10. Manned ranges support training in a wide variety of tactics for air-to-ground attack. The student goes through a series of progressive skill and confidence building steps. Each training step builds on the previous until the complete skill package is mastered.

One of the values of manned range training is that each aircraft typically can make 9 to 12 single release bomb or rocket passes and 6 gun passes per sortie. Another value is that personnel are on site in the observation towers to provide aircrews with immediate feedback on the score of each of their attacks. The combination of being able to perform a high number of bomb, rocket, or strafe attacks and receive immediate scoring feedback is the key to improving student performance.

FIGURE 3-2

TOTAL BMGR ANNUAL SORTIES 1987-1996
11 X 8 ½ B/W

In FY 1996, Range 1 supported 5,081 training sorties, Range 2 supported 5,003 sorties, Range 3 supported 2,287 sorties, and Range 4 supported 4,300 sorties.

TAC Range Operations

TAC ranges are used to teach aircrews how to fly and fight within the air-ground battle area. The training leads aircrews through a progression of increasingly difficult tactical challenges that test the repertoire of skills developed on manned ranges. Ordnance authorized for use on TAC ranges includes training practice munitions, full size inert bombs, and armed general purpose bombs, rockets, and air-to-ground missiles.

The progress aircrews make on TAC ranges towards hitting targets is evaluated in two ways, by the aircrews themselves or by a Television Ordnance Scoring System (TOSS). Student aircrews or instructors can judge the accuracy of their own bomb or rocket attacks by watching for the smoke from the signal cartridges that ignites in training and inert ordnance when it hits. The accuracy of strafing fire is observed directly by the shooting pilot. Hits with live ordnance on designated live ordnance targets are also assessed by the attacking aircrews and instructor pilots. Personnel operating the TOSS cameras from Gila Bend AFAF inform aircrews of their accuracy via radio.

Fixed-wing aircraft are typically able to carry enough ordnance for each aircrew to make three to six bomb or rocket passes and three strafing passes per TAC range sortie. During FY 1996, 12,447 sorties were flown on North TAC Range; 13,486 were flown on South TAC Range; and 7,128 were flown on East TAC Range.

Air-to-Air Firing Range Operations

Aerial gunnery training is performed by a flight of aircraft including the gunnery target tow aircraft and two to four shooter aircraft. This training is currently being performed only by the 162 FW and all tow and shooter aircraft are F-16s. The Aerial Gunnery Target System (AGTS) tow target is reeled out and in on a cable from a pod attached under the wing of the tow aircraft. The AGTS is about 12 feet long. Shooter aircraft make firing passes at the deployed AGTS while flying prescribed patterns designed to keep both the tow and shooter aircraft out of danger. Shooting is suspended whenever the shooter draws within 2 NM of the firing area box on an outbound course. Thirty-six aerial gunnery sorties were performed during FY 1996.

TABLE 3-3
MILITARY FLIGHT TRAINING ACTIVITIES BY BMGR SUBRANGE
11 X 17

R-2301E Air-to-Air/Range Operations

The R-2301E air-to-air range supports a host of air combat training activities, including air combat maneuvering, basic fighter maneuvers, and dissimilar aircraft combat training (see Table 3-3). These activities accounted for 86 percent of the 12,127 sorties (not counting 36 aerial gunnery sorties) flown in the air-to-air range in FY 1996. Of the remaining 1,728 sorties, 7 percent were flown as dry fire (non-firing) aerial gunnery missions. The remaining 7 percent included instrument, low altitude, electronic warfare, Low Altitude Navigation and Targeting Infrared for Night (LANTIRN), aerial refueling, and transition flight training.

Western ARNG Aviation Training Site and 1/258 Attack Helicopter Battalion

The National Guard Bureau has centralized certain types of helicopter training for the ARNG at two locations in the United States. One of these locations is the Western Army National Guard Aviation Training Site (WAATS) at the Silverbell Army Heliport, at Pinal County Air Park near Marana, Arizona, about 30 miles northwest of Tucson, Arizona (see Figure 1-3). This heliport is also home to the 1/258 Attack Helicopter Battalion (AHB). Pilot and instructor pilot qualification is a key training mission of the WAATS. The 1/258 AHB flies readiness training missions to maintain its status as a combat ready unit.

The WAATS became operational in Arizona in 1986 because of the availability of the BMGR for weapons training and year-round flight training capabilities (National Guard Bureau 1997). WAATS currently trains 2,347 students annually. There is a potential that a future increase to 5,104 personnel annually may be required due to the downsizing of the active-duty forces. Some of the WAATS training is done at locations outside of the BMGR; however, live-fire weapons training occurs in the BMGR restricted areas. Approximately 67 percent of WAATS and 1/258 AHB weapons training needs are accomplished on East TAC Range and Manned Range 3. The remaining 33 percent is accomplished on North TAC Range.

The aircraft from WAATS also use facilities at Gila Bend AFAF for refueling and crew change. This allows an increase in the productivity of each training mission. The present flying itinerary is from the WAATS to Gila Bend AFAF, to the range, to Gila Bend AFAF, and then at the completion of training, returning to the WAATS. The entire round trip movement from the WAATS to Gila Bend AFAF is used for low-altitude tactical flight training. The WAATS and 1/258 AHB combined flew about 1,000 sorties on the BMGR during FY 1996. With the approved Record of Decision (ROD) for the WAATS EIS, the number of sorties on the BMGR is expected to increase to approximately 2,000 sorties for the WAATS and 1/258 AHB combined.

Marine Corps/Navy Training Operations

The Marine Corps and Navy have both been important users of the BMGR. The ongoing conversion of NAS Miramar to MCAS Miramar by FY 1999 has reduced the Navy's training use of the BMGR as many of its units have moved to installations outside of the region. MCAS Yuma and the BMGR will continue to serve as a very active deployment destination for both Marine Corps and Navy air units.

The airspace and land-based facilities on the Marine Corps side of the BMGR support a wide variety of flight training activities (see Table 3-3). These facilities are used to improve and maintain the skills of individual aircrew. However, because most of the squadrons that use this side of the range are operational rather than training units, emphasis is also placed on exercises that build tactical teamwork, confidence, and unit cohesiveness. This training effort is extended within the Marine Corps to foster coordination between its ground and air units. Involved ground units include those responsible for air defense, communication, air control, electronic warfare, and expeditionary airfield support. The TACTS range is at the heart of this type of large force integrated training.

TACTS Range Operations

The TACTS Range is used on a daily basis to hone aircrew skills and coordination in air-to-air combat. TACTS Range use often emphasizes large force challenges with four, six, eight, or more aircraft on a side. There is also a strong emphasis on preparing operational aircrews to face aircraft and tactics like those that would be flown by a potential enemy. Providing this dissimilar aircraft and tactic training challenge is the purpose of the "aggressor" squadron, VMFT-401, at MCAS Yuma. VMFT-401 personnel train to fly and fight their F-5E aircraft to simulate the performance and tactics that could be expected of a potential enemy.

The realism of air-to-air and air-to-ground training on the Marine Corps side of the BMGR is enhanced by the system of threat emitters that is being integrated into the TACTS Range. By simulating the radar emissions of surface-to-air missile systems or anti-aircraft artillery, the threat emitters coupled with the aggressor squadron complete the circle of airborne and ground-based air defense forces that U.S. aircrews may face in actual combat.

The final TACTS Range element is the use of Smokey surface-to-air missiles (SAMs) to enhance the visual realism of the air-ground training environment. Smokey SAMs are small (less than 24 inches long) solid fuel rockets made out of cardboard tubing and plastic foam that can generate a visible smoke column to about 1,000 feet AGL when launched. These rockets are used to simulate the initial boost phase of a surface-to-air missile launch. Smokey SAMs are launched in conjunction with threat emitter transmissions to give aircrews visual as well as electronic cues that they have been engaged by a surface-to-air missile and that evasive action is in order. Smokey SAMs have no tracking capability and are unlikely to hit an aircraft. Nevertheless, the soft construction of these decoys is designed to prevent damage to an aircraft.

TACTS Range use is estimated to be about 50 percent of the total R-2301W sorties. The remaining sorties are flown in the Moving Sands, Cactus West, and AUX-2 complexes. Based on the ratio from a 1992 survey, TACTS Range use in FY 1996 would have been 5,487 sorties. The Moving Sands, Cactus West, and AUX-2 complexes combined would have supported the same amount of use.

WTI Course Operations

The WTI course is conducted twice a year by Marine Aviation Weapons and Tactics Squadron One (MAWTS-1) stationed at MCAS Yuma. The WTI course provides graduate level training in Marine aviation weapons and tactics. The course includes approximately six weeks of intensive academics, command and control integration, and flight instruction. The course is designed to provide one WTI or WTI aircrew per squadron or unit per year to enhance service-wide capabilities.

Officers from Marine infantry and ground support units also attend the WTI course to strengthen the interfaces between air and ground units. The course requires deployment of Marine ground units to perform land-based air control, air defense, electronic warfare, communications, and forward area helicopter refueling and rearming, as well as other functions to help create a complex air-ground battlefield with sophisticated air defense threat capabilities.

Ground unit deployments occur only within the Marine Corps and Air Force land sections of the BMGR. Military ground units enter the Cabeza Prieta NWR, only after special coordination with the refuge.

The WTI course includes three phases: academics, flight instruction, and final exercise. The flight phase begins the third week of the course. The last week of the course is set aside for a final exercise that is essential to WTI training. During this capstone event, WTI students plan, execute, and debrief missions that integrate all facets of Marine aviation in a simulated battlefield environment on the BMGR that incorporates hostile air and ground forces and friendly supporting ground forces.

The entire BMGR and the Dome MOA are required for the final exercise, which may incorporate as many as 80 tactical aircraft of all types. The ground units that deploy to the BMGR for the WTI course and several other Marine Corps aviation related training exercises use 36 ground support areas positioned throughout the Marine Corps section of the range (see Figure 1-2). Ground support areas are used interchangeably for a variety of uses such as base camps; forward arming and refueling points (FARPs); and mobile radar, communications, and anti-aircraft missile sites. All of these support areas are located adjacent to established roads to allow for vehicle access.

The principal impacts within support areas are from use by heavy vehicles (2.5- to 15-ton trucks, many with dual tires and all axle drive trains) and foot traffic from tens to hundreds of troops. In some locations, years of repeated use has caused considerable soil disturbance.

Other types of potential impacts from ground troop deployments are largely prevented by enforcement of environmental regulations. Human sewage at base camps and other locations of troop concentrations is contained in portable toilets and removed by commercial contractor to approved sewage treatment facilities. All litter is policed and contained daily to be carried off the range to approved landfill sites. Vehicles are restricted to approved roads except when operating in a designated ground support area. Fuel tankers, vehicles being fueled, and other stationary equipment such as generators that may leak fuels or lubricants are placed over temporary containment aprons formed by plastic sheeting and sandbags to catch inadvertent spills. A hazardous materials response plan and team is in place at MCAS Yuma to respond immediately to any spills.

Stinger-teams are two- to four-man teams that employ the Stinger anti-aircraft missile for low altitude air defense. These teams may operate at any of the 36 ground support areas during a training exercise; may use any of 10 typically used areas; or may disperse to other range locations (see Figure 1-2). Stinger-teams drive High-Mobility Multipurpose Wheeled Vehicles (HMMWV), a 2.5-ton jeep-type vehicle. They are authorized to drive off of roads to clear the roadway and park but are limited to within approximately 25 feet of the road.

The multiplicity of ground support areas on the BMGR give ground units the ability to evaluate and choose among the same types of tactical and logistical options that they face in actual combat. The presence of ground forces, in turn, benefits flight training as aircrews can coordinate with friendly ground forces or react to aggressor ground forces that are behaving realistically. The support areas are numerous enough that they are not all used during one WTI course.

The low-level R-2301W/E airspace overlying the Cabeza Prieta NWR is critical to the instructional quality of the final WTI exercise. Because of the geography of the BMGR, east-west lines of movement are used in the WTI battle scenario by the attacking and defending air forces. Fixed-wing aircraft actions at all altitudes must be incorporated by WTI students as they plan and then seek the advantage against the air and ground forces arrayed against them. Helicopter planners and aircrews have no choice except to use all available low-level airspace to their best advantage.

Specific flight corridors for low-level overflight of the Cabeza Prieta NWR have been established through a 1994 Memorandum of Understanding (MOU) with the USFWS as sanctioned by P.L. 99-606 (see Figure 1-2).

The amount of WTI training use that the low-level corridors over the Cabeza Prieta NWR receive varies from course to course. Between 120 and 240 overflights of the refuge by individual fixed-wing aircraft could occur during a course. The total annual fixed-wing overflight time for two WTI courses varies between 7 and 14 hours. About 15 percent of the fixed-wing overflights during a WTI course are at night. The distribution of flights on the two fixed-wing corridors would be roughly equal.

The total number of helicopter overflights of the Cabeza Prieta NWR per course is usually

between 20 and 40. The total annual helicopter overflight time for two WTI courses typically varies between 5 and 10 hours. The lower limit for helicopters overflight time can be less than an hour and has been zero in cases when WTI students selected only northern routings in response to some course battle scenarios. As much as 50 to 100 percent of the rotary-wing flight time of a WTI course over the Cabeza Prieta NWR can be at night.

HAWK FIREX

HAWK FIREX is a live-fire exercise that has occurred on the BMGR since 1970. During HAWK firing times (usually on weekends), aircraft use of R-2301W and R-2301E is restricted to prevent risks to aircrews. For more than the last 10 years the FIREX has been conducted from the eastern side of the Baker Peaks site (see Figure 1-2). Earlier FIREXs were located on the eastern side of the Tinajas Altas and Gila mountains. When the Baker Peaks site is used, the western ground section of the BMGR is closed east of a line extending north from the western Cabeza Prieta NWR boundary to the BMGR boundary. This closure applies to all ground entry except for authorized personnel at the Baker Peak site. Access to the Cabeza Prieta NWR is restricted at its north (Tacna) entrance on FIREX days. Ground-launched target drones are remotely piloted throughout the R-2301W/E airspace. Individual firing platoons are directed to engage these target drones with live HAWK missiles. The direction of fire is to the east-southeast from the Baker Peak site with target impact usually occurring over the Mohawk Valley.

Early Warning Control Training

Early warning control training provides personnel in a Marine Air Control Squadron (MACS) with the initial and recurrent training experience necessary to deploy to tactical locations and to conduct combat operations. This training is scheduled irregularly and typically occurs in the Baker Peaks/East Copper mountains area, although it may occur in other tactically appropriate ground support areas. The training generally lasts one to three weeks.

Low-altitude Anti-aircraft Defense Team Training

Low-altitude Anti-aircraft Defense (LAAD) teams use stinger missiles to provide local low-altitude air defense. The primary emphasis of this exercise is to gain experience in the planning and selection of tactical firing sites for Stinger teams.

Stinger teams use existing roads to reach their selected team site. The vehicles may be pulled off of the road in order to facilitate camouflaging it from aerial observation and to clear the road for other traffic.

Other DoD and Marine Corps Exercises

Other DoD and Marine Corps training/testing exercises may occur on the BMGR on an irregular basis. These exercises could include aviation units from the Air Force and Navy as well as aviation and aviation-related ground units from the Marine Corps. Aviation and ground units deployed in conjunction with these exercises conduct operations in the same manner as the exercises described above. Exercises are normally short, lasting three to five days.

Aerial Refueling

Some Marine Corps training operations, such as the final exercise of the WTI course, require aerial refueling. Temporary aerial refueling routes are flown in the Dome MOA/ATCAA or R-2301W to support missions needing refueling services.

Operation Snowbird

The Air Force hosts its continuing BMGR training deployment program through Operation Snowbird operated by the 162nd FW at Davis-Monthan AFB. Operation Snowbird is designed to allow units impacted by weather circumstances at their home locations to meet their training needs by deploying to Arizona to take advantage of the flying weather and the training capabilities of the BMGR. Deployed units hosted by Operation Snowbird are afforded the distinct advantage of regular rather than casual user priority for BMGR scheduling purposes.

During the five-year period between 1991 and 1995, 37 different units deployed between 8 and 15 aircraft each to Davis-Monthan AFB to use the BMGR. This totaled 69 deployments, lasting from one to four weeks, originating from 24 states and overseas bases. The flying units involved included Air Force, ANG, and Air Force Reserve units.

Military Training Route Operations

During FY 1996, a total of 15,808 aircraft sorties were flown on the 14 MTRs that enter the Air Force side of the BMGR. The four MTRs that enter the Marine Corps side of the range carried a combined traffic load of 880 sorties during the same year.
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3.3.3 Ordnance Use

Explosive Ordnance Disposal Operations

A wide array of training ordnance, full-size inert ordnance, and live ordnance is used on the BMGR for aircrew training (Table 3-4). An ongoing decontamination program to control surface build-up of ordnance on BMGR target ranges is in place for safety and environmental management purposes. Section 7 of P.L. 99-606 requires the Air Force to periodically decontaminate the BMGR to at least the level of cleanup achieved in 1986. The 56 Explosive

Ordnance Disposal (EOD) Flight clears the munitions from the surface of the manned and tactical ranges in the eastern section of the BMGR. Marine Corps Range Management Department EOD personnel clear munitions from the Moving Sands and Cactus West Target Complex. Unless a special circumstance occurs, no attempt is made to locate or remove inert or unexploded live ordnance delivered on the BMGR that may have been buried beneath the ground surface by the force of delivery upon impact with the surface (DoD, Luke AFB 1996). Special circumstances would include burial of a bomb of unknown type beneath the surface of a range maintenance road (as evidenced by a delivery impact crater or a visible portion of the munition) or some other major ground use area. Buried live or potentially live munitions in these circumstances would be excavated to the extent necessary to detonate it in place with an EOD charge (Westby 1997).

Manned range EOD sweeps are conducted at a radius of 500 feet every 50-use days (bimonthly), 4,000 feet annually, and 1 NM (6,080 feet) every five years (DoD, Luke AFB 1996). Tactical ranges are cleared annually to a distance of 1,000 feet from the target edge and every five years to a distance of 1 NM from the target edge. The five-year sweep areas often overlap because of the proximity of tactical targets to each other (Westby 1997).

The Air Force EOD cleanup process requires that trucks spaced at about 100-foot intervals in a line-abreast formation be driven along parallel transects across the sweep areas. Lightweight inert ordnance is tossed into the trucks to be carried off the range. Heavy inert bombs are hooked to “drag chains” attached to the back of the trucks, dragged to loading areas, and transported off-range for recycling and disposal. Armed explosive ordnance is detonated in place. Most bomb casings are made of a high grade steel that is desirable for recycling.

TABLE 3-4 ORDNANCE EXPENDED ON BMGR IN FY 1996			
Ordnance Nomenclature	Ordnance Description(a)	R-2301W(b)	R-2301E, R-2304, R-2305(c)
5" Zuni Rocket	5" Zuni Rocket	42	
.50 Cal.	.50 Caliber Machine Gun Round	164,800	
7.62 MM	7.62 MM Machine Gun Round	74,350	
BDU-33	25 lb. Practice (Inert) Bomb	225	123,579
BDU-45	500 lb. Practice (Inert) Bomb	1,327	
BDU-48	10 lb. Practice (Inert) Bomb	1,364	
Flares	Flares	8,954	282,919
MK-76	25 lb. Practice (Inert) Bomb	10,924	
MK-81 (inert)	250 lb. Bomb (Inert)		
MI-82 (inert)	500 lb. Bomb	0	1,151
MK-82 (live)	500 lb. Bomb	0	1,209
MK-83 (inert)	1,000 lb. Bomb (Inert)	286	
MK-84 (inert)	2,000 lb. Bomb		433
MK-84 (live)	2,000 lb. Bomb	16(d)	456
MK-106	5 lb. Practice Bomb		
MK-189	Flares		57,313
RR-188	Chaff, Training	9,512	145,278
RR-170	Chaff, Actual		14,573
BDU-50	2,000 lb. Bomb (Inert)		3,301
GBU-12	500 lb. Glide Bomb		221
20 MM	Ammunition	62,018	807,143
MJU-7	Flares		19,013
30 MM	Ammunition	200	1,154,824
LUU-1	Flare, Illumination		1,594
LUU-2	Flare, Illumination		3,685
M-206	Flare, Illumination		154,317
PV-29	Hell Fire Missile		12
PE-63	Tow Missile-Practice		154,317
2.75 WP	Rocket, White Phosphorus		14,630
2.75 TP	Rocket, White Phosphorus, Training	350	1,273
AGM-65A (live)	Maverick, TV Guidance		3
AGM-65B (live)	Maverick, IR Guidance		11
AGM-65D (live)	Maverick, IR Guidance, Revised		33
AGM-65G (live)	Maverick, Dual Guidance		27
HAWK (live)	HAWK Surface-to-air Antiaircraft Missile	12 (e)	
Stinger (live)	Stinger Surface-to-air Antiaircraft Missile	20 (e)	
Smokey SAM (inert)	Simulated Surface-to-air Antiaircraft Missile	600 (e)	120 (e)
(a) All ordnance is inert unless indicated as live. (b) MCAS Yuma data. (c) Luke AFB data. (d) Live but unarmed MK-84s jettisoned but recovered at live ordnance jettison area. (e) Typical expenditures			

Munitions decontamination and maintenance of the Moving Sands and Cactus West target complexes are accomplished by EOD teams and maintenance crews directed by the Range

Management Department at MCAS Yuma. No live ordnance, special weapons, cluster bombs, or munitions requiring immediate recovery are authorized for use on these targets. EOD sweeps and target maintenance are performed up to four times annually to keep the Moving Sand and Cactus West complexes in a serviceable condition.

Ordnance Distribution

Although nearly all locations within the BMGR would have to be regarded as suspect for contamination with potentially hazardous munitions, the likely relative concentrations of expended ordnance within various range areas can be approximated according to the historic patterns of munitions use. Ranked in descending order, the three BMGR areas with the greatest potentials for contamination with expended ordnance include the following:

- 1. North, South, and East TAC Ranges.** The highest concentration of targets approved for inert air-to-ground ordnance and all five BMGR targets authorized for live ordnance use are located in North, South, and East TAC ranges (Figures 3-3 and 3-4). Most of the inert ordnance targets and the two live Maverick Missile targets are located in the alluvial plains where the potential for munitions to be buried on impact or by later sedimentation is the highest. The three HE Hill targets are either basalt or granite outcroppings located within either alluvial basins (North and South TAC) or an upper bajada (East TAC). High explosives dropped on these targets that fail to explode can end up buried within the rubble and highly fractured base rock of the target hills or the alluvium surrounding the hills.

Annual and five year EOD sweeps clear inert and live munitions from the surfaces of TAC range targets and surrounding plains out to distances of 1,000 feet and one nautical mile, respectively. An analysis of the munitions impact footprints within the TAC ranges and the experience of Air Force EOD personnel indicate that the ongoing EOD programs are highly effective for clearing munitions from the swept range surfaces. However, buried munitions and those lodged in mountainous terrain in the vicinity of targets that is inaccessible to EOD sweep vehicles are not cleared from the range.

- 2. Manned Ranges 1, 2, 3, and 4; Moving Sands/Cactus West; and Former Targets.** Manned Ranges 1, 2, 3, and 4 are located within alluvial plains. These ranges have been active in these locations and in the same approximate layouts since the mid 1960s (see Figure 1-2). Ordnance use on these ranges has always been restricted to inert munitions. Authorized bombs have been further restricted to subscale training munitions except for full-sized practice bomb shapes used to simulate nuclear weapons drops. Ongoing periodic EOD procedures effectively clear expended munitions from manned range surfaces but do not eliminate ordnance that may be buried. Some buried ordnance likely contain unfired signal cartridges of unexploded live ordnance. These practice munitions are potentially dangerous.

Moving Sands and Cactus West are similar to Manned Ranges 1, 2, 3, and 4 in terms of being located on alluvial plains and being restricted to inert ordnance use. In addition to subscale training bombs, however, Moving Sands and Cactus West are also authorized for use with full-scale inert conventional bombs of up to 1,000 pounds. EOD operations effectively clear the surface of these targets on a routine periodic basis but buried munitions are neither identified nor removed.

A number of formerly active target areas have been identified on the BMGR. On the Air Force side of the range, several air-to-ground ranges that were precursors of today's manned ranges were located in the same vicinities as the manned ranges. Two known air-to-ground targets within the Marine Corps operating area were the Rakish Litter and Panel Stager targets east and south of AUX-2 (see Figure 1-2). Until 1986, these inactive targets served training functions that are now supported by Moving Sands and Cactus West.

The former Air Force ground range targets and Rakish Litter and Panel Stager were all located on alluvial soils and were restricted to use with inert munitions. Routine EOD procedures kept the surfaces of these targets clear of munitions accumulations, but did not identify or dispose of subsurface ordnance.

An accumulation of buried munitions has likely occurred in and around Manned Ranges 1, 2, 3, and 4 and Moving Sands and Cactus West after years of training use. Similar accumulations of munitions may lie beneath the former Air Force ground range targets and the inactive Rakish Litter and Panel Stager targets operated by the Marine Corps. Although they are not nearly as dangerous as unexploded live ordnance, the potential of encountering buried inert munitions with unfired signal cartridges must be evaluated prior to implementing ground disturbing activities.

- 3. Air-to-Air Firing Range and Other Air-to-Air Firing Areas.** The existing air-to-air firing range is currently used for aerial gunnery only. Intact cannon or machine gun rounds may be found on or below the surface of the lands underlying this range as a result of current or past gunnery training. Unfired rounds are those that were not fired by an aircraft cannon or gun because of a misfire or gun jam but were ejected intact from the aircraft. Records indicate that cannon rounds with live warheads have not been used on the range but the explosive propellants in cannon or machine gun cartridges could be hazardous. BMGR lands to the north, east, and south of the current range may be similarly contaminated as a result of operations in the past when the aerial gunnery range encompassed a larger area (see Figure 1-2). The level of danger associated with unfired cannon or machine gun rounds may not preclude new surface uses but the hazard presented by these munitions could affect how such uses might be implemented.

More important as a possible hazard within these lands as well as within much of the range area underlying R-2301W is the potential presence of rockets or missiles expended in past air-to-air combat training. Air Force training conducted in the 1960s included an operation designed to familiarize aircrews with the procedures and effects of firing live

air-to-air heat-seeking missiles. The activity required aircrews to launch an unguided aerial rocket forward from their aircraft to simulate the hot exhaust of an enemy aircraft. A heat-seeking air-to-air missile with live high-explosive warheads was then launched by the same aircrew to intercept the target rocket. The usual outcome of these events was the aerial destruction of both the rocket and the missile. However, not all rocket or missile motors ignited and not all missile warheads detonated. As a result, an undetermined number of expended rockets or missiles or parts of these weapons with unburned propellant or unexploded warheads are likely dispersed on or below the surface of the BMGR lands underlying the training airspace.

During the 1950s, the Air Force conducted similar training over the western side of the BMGR that now underlies R-2301W. In this case, rockets were launched from aircraft at aerial targets towed by another aircraft. After 1960, the Marine Corps periodically fired air-to-air missiles at targets in this same airspace. Air-to-air gunnery training also occurred in this airspace during past decades. These past aerial training activities raise the potential that the surface and subsurface of the underlying range lands are contaminated to some degree with rockets and missiles containing unburned propellants or undetonated warheads. Cannon or machine gun rounds with unfired propellant cartridges are also likely to be present.

3.3.4 Summary of Military Road and Surface Use

Military operations within the BMGR are supported by 572 miles of primary, secondary, or tertiary roads (Table 3-5, see Figure 1-2) (DoD, Luke AFB 1998). These established roads provide surface access to, between, or within the various functional areas of the range. These roads are used by military or civilian personnel and vehicles involved in the various training and training support functions described above in Sections 3.3.2 and 3.3.3. In addition to these roads, vehicles required for training, EOD, or maintenance functions are driven off of established roads in Marine Corps ground support areas and within tactical and manned range EOD sweep areas. Off-road traffic within these areas has established vehicle trails or tracks that may be used repeatedly during successive training, EOD, or maintenance cycles. Some of this traffic, especially when performing EOD sweeps, must unavoidably follow single pass routes within ground support or sweep areas.

Almost 360,000 acres, or 13.5 percent of the 2,668,100 acres within the BMGR, are or have been used to directly support military operations (DoD, Luke AFB 1998). Included within these direct 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 over a wide range from negligible to complete disruption (Table 3-6).

Of the almost 360,000 direct use acres, nearly 188,000 acres (see Table 3-6, sum of lines 1 and 2) serve as the active and inactive fall out areas for aerial gunnery training munitions and targets.

Although the formerly used DARTsXwhich are widely and unevenly scattered over the areaXare visually noticeable due to their shiny aluminum skins, the physical disturbance from munitions and target fall out is cumulatively negligible.

The remaining cumulative military surface use area is 171,720 acres (see Table 3-6, sum of lines 3 through 5 and 8 through 23) or about 6 percent of the total BMGR area. Nearly 69 percent, or 118,523 acres (see Table 3-6, sum of lines 5, 8, 19, and 20), of this remaining cumulative surface use is located within the three tactical ranges (Figures 3-3 and 3-4). An additional almost 21 percent of this use, or 36,100 acres (see Table 3-6, sum of lines 3, 4, 16, and 18), is associated with the layout and use of the four manned ranges and almost 7 percent of this use, or 10,922 acres (see Table 3-6, line 14), is associated with the designated Marine Corps ground support areas. Figure 3-5 shows a portion of the western section of the BMGR where most of the ground support areas are located. The remaining 6,175 acres (see Table 3-6, sum of lines 9, 10, 11, 12, 14, 15, 17, 21, 22, and 23) are scattered about the range in the form of auxiliary airfields, retired target and test areas, developed training sites, maintenance and cleanup support areas, and the Moving Sands/Cactus West targets (see Table 3-6).

The levels of surface disturbance associated with the 171,720 acres of military use areas range from low to complete. Areas rated as having high to complete levels of surface disturbance, however, are limited to less than 2 percent of the BMGR surface (see Table 3-6).

TABLE 3-5 MILITARY ROADS WITHIN THE BMGR		
Air Force Road Class	Miles in Class	Comments
Primary. Primary roads include all highways serving as main distribution arteries for all traffic originating within and outside of the BMGR. Primary roads provide access to, through, and between various functional areas.	29	Interstate Highway 8, State Route 85, Avenue 3E/County 19 th Street (Yuma County), and several other Yuma and Maricopa county roads provide primary access to the BMGR, but are not managed by the Air Force or Marine Corps. State Route 85 is the only primary class road within the range. The figure listed under Miles in Class pertains to the length of State Route 85 within the BMGR.
Secondary. Secondary roads include all BMGR roads that provide access to, between, and within the various functional areas.	200	The secondary military use roads within the TACTS Range subrange serve as both military and public access roads. Other secondary military roads within the range are generally not available for public use.
Tertiary. Tertiary roads include all BMGR roads providing access from other roads to individual units or locations within the various functional areas.	343	Most of the tertiary military use roads within the TACTS Range subrange and one within the Moving Sands/Cactus West Target subrange support military and public access. Tertiary military roads within the Eastern Section are generally closed to public access.
Patrol. Patrol roads on the BMGR include roads used for surveillance or in patrolling areas for security purposes and roads constructed (or reconstructed) for Border Patrol “drag roads.” Drag roads are maintained and used by the Border Patrol to reveal the foot traffic of persons illegally entering the United States from Mexico.	Not identified separate from secondary and tertiary roads.	Although drag roads qualify as patrol roads, some are also used to support military activities. Drag roads used for military purposes are consequently classified as secondary roads within the inventory.
Unimproved, Primitive Track, or Single Pass Trail. Unimproved roads are dirt tracks that are seldom or never maintained, but which are periodically traveled and easily followed. Primitive tracks are dirt roadways that are never maintained and have been rarely or never traveled in recent years. They are in various stages of revegetation and soil recovery. Single pass trail is the track left by the one-time passage of a vehicle traveling off-road. Depending on the size of the vehicle and the type and wetness of the soil, a single pass trail may vary from being undetectable to being a sharply apparent scar.	Not identified separate from ground support and EOD sweep areas.	The several thousands of miles of unimproved roads, primitive tracks, and single pass trails are located within the troop deployment ground support areas used by the Marine Corps and the Air Force target maintenance and EOD sweep areas. A definitive inventory of these roads/tracks/trails has not occurred. Vehicle use of these support, maintenance, and EOD sweep areas is accounted for, however, in Table 3-6.

TABLE 3-6				
MILITARY SURFACE USES WITHIN THE BMGR GROUPED				
BY ASSOCIATED LEVELS OF SURFACE DISTURBANCE				
Line	Military Surface Uses (Acres Included)	Associated Surface Disturbance	Total Acres	Percentage of BMGR Affected*
1. 2.	Primary air-to-air gunnery range (101,040) Inactive alternative air-to-air gunnery range (86,914)	Use causes negligible levels of disturbance to soil surface or vegetation community across affected area	187,954	7.04
3. 4. 5.	Manned range annual EOD sweep area (7,615) Manned range five-year EOD sweep areas (27,238) Tactical range five-year EOD sweep area (92,548)	Use causes low to moderate levels of disturbance to soil surface of vegetation community across affected area	127,401	4.78
6. 7. 8. 9. 10. 11. 12. 13. 14.	HE hill dispersed munitions blast area (2,976) Tactical range inert target munitions impact area (17,154) Tactical range annual EOD sweep area (25,494) AUX-6 (182) Stoval Auxiliary Airfield (182) AUX-2 (215) Closed auxiliary airfields (910) Ground troop deployment support areas (10,922) Retired target areas (823)	Use causes low to high levels of disturbance to soil surface or vegetation community across affected area	38,728**	1.45
15. 16. 17.	Gila Bend AFAP (2,007) Manned range 50-use day EOD sweep area (308) Range maintenance, cleanup, and EOD support areas (435)	Use causes moderate to high levels of disturbance to soil surface or vegetation community across affected area	2,750	0.10
18. 19. 20. 21. 22. 23.	Manned range cleared layout and targets (939) Tactical range cleared-target simulations (430) HE hill target core munitions blast areas (51) Moving Sands/Cactus West cleared target centers (400) Developed training sites (180) Retired test areas (841)	Use causes high to complete levels of disturbance to soil surface or vegetation community across affected area	2,841	0.11
24.	Total Military Surface Use Acres		359,683	13.48
<p>*Percentages for each line are calculated as line area divided by the area of the BMGR (2,668,100 acres). **This total does not include the acreages within the HE Hill dispersed munitions blast area (Line 6) or the tactical range inert target munitions impact areas (Line 7) because these areas lie almost entirely within the tactical range annual EOD sweep area.</p>				

FIGURE 3-3

MILITARY ROADS AND SURFACE USE WITHIN

NORTH AND SOUTH TAC RANGES
8 ½ x 11 B&W

FIGURE 3-4

MILITARY ROADS AND SURFACE USE WITHIN
EAST TAC RANGES
8 ½ x 11 B&W

FIGURE 3-5

MILITARY ROADS AND SURFACE USE WITHIN
THE BMGR WESTERN SECTION
8 ½ x 11 B&W

3.3.5 Non-BMGR Military Airspace And Ranges

Although the BMGR serves as a cornerstone for much of the tactical aviation training that occurs in southern Arizona and California, a number of other military airspace and range areas contribute importantly to the overall value of the region for training (see Figure 1-4). BMGR users make use of 43 Special Use Airspace (SUA) areas and 15 ATCAAs within the region but outside of the BMGR (Table 3-7). The Chocolate Mountain Aerial Gunnery Range³⁶ (underlying R-2507 N/S) and Sells North and South Low Altitude Tactical Navigation (LATN) areas³⁷ are also within the local training area.

Training missions typically flown in MOAs and ATCAAs include transition training, aerial refueling, familiarization flights, post maintenance check flights, instrument flight training, basic fighter maneuvers, fighter intercepts, air combat maneuvering, and dissimilar aircraft combat tactics (see Table 3-3 for definitions). Because nonparticipating VFR air traffic may enter an active MOA, the air-to-air combat training missions flown are kept to a measure of complexity and aircrew skill level consistent with prevailing visibility conditions and the see and avoid responsibilities of the aircrews. Student training in advanced air-to-air combat is assigned to restricted airspace where nonparticipating traffic is excluded.

The Sells and Dome airspace complexes are of special interest because they are contiguous with BMGR restricted airspace and can be used directly to support BMGR training missions (see Figure 1-4). The Sells complex includes the Sells LATN areas, Sells Low MOA, Sells 1 MOA, and Sells ATCAA. The Dome complex includes the Dome MOA and ATCAA.

The Sells LATN and Sells Low MOA are used independently from the BMGR for flight training at low to medium altitudes. These airspace areas are also used as transition or holding areas for flights to and from the BMGR and Davis-Monthan AFB or Silverbell Army Heliport (see Figure 1-4).

³⁶ The Chocolate Mountain Aerial Gunnery Range is a 719 square mile live-fire bombing and gunnery range operated by the Marine Corps through MCAS Yuma. The Chocolate Mountain Aerial Gunnery Range is used extensively by Marine Corps and Navy units.

³⁷ The Sells South LATN area extends from 100 feet AGL up to but not including 3,000 feet AGL. The North LATN area extends from 100 feet to 1,000 feet AGL.

TABLE 3-7
11 X 17 (2 PAGES)

Table 3-7 (continued)

The Sells 1 MOA and Sells ATCAA are also used independently of the BMGR for the wide variety of training activities typically flown in MOA and ATCAA airspace. The Sells airspace has been partitioned laterally and vertically to facilitate simultaneous but independent training by more than one group of aircraft (Figure 3-6). These airspaces are also used as higher altitude transition or holding areas for aircraft going to or from the BMGR or as staging areas for multiple aircraft flights preparing for training missions within the BMGR.

The most direct use of Sells airspace for BMGR training missions incorporates Sells area E in a block with selected portions of the R-2301E air-to-air range (Figure 3-7). This block of airspace provides sufficient distance over which two or more aircraft can be separated before flying towards each other to practice simulated engagements with long range air-to-air weapons such as the AIM-120.³⁸ The orientation of these training engagements is patterned not only to allow fighters to initiate the fight over long distances but also to take advantage of the GRMDS on the BMGR to record and replay the engagement. Following the long-range maneuvers, aircrews practice visual air combat maneuvers and tactics as their aircraft close to within sight of each other and within the effective range of shorter range missiles or the aircraft gun.

The Dome MOA and ATCAA were originally established to support WTI course air operations at the BMGR. Annual use of this MOA and ATCAA has expanded to some non-WTI course periods but remains at a relatively moderate level (1,590 operations in FY 1996). Users continue to schedule the Dome airspace jointly with R-2301W to support activities such as aerial refueling, airborne command and control, air combat maneuvering, and post maintenance check flights.

3.4 NON-MILITARY LAND AND AIRSPACE USE

Although the current land withdrawal and reservation of the BMGR (P.L. 99-606) reserves the BMGR primarily for military purposes, it also allows for non-military use subject to the constraints of the overriding military mission for which the range was established. The BMGR is accessible for compatible non-military use subject to the permitting system of the administering agency. The Air Force and Marine Corps are responsible for issuing access permits for non-

³⁸ The air intercept missile (AIM) 120 developed by Hughes Missile Systems is also known as the Advanced Medium Range Air-to-air Missile. The AIM-120 has a range of more than 30 NMs and can be used to engage an enemy aircraft that is beyond the visual range of the pilot.

FIGURE 3-6
OPERATION SECTORS WITHIN THE SELLS MILITARY OPERATIONS AREA
COMPLEX
11 x 8 ½ B&W

FIGURE 3-7
AIR-TO-AIR HIGH/SELLS E LONG-RANGE ENGAGEMENT AIRSPACE
11 x 8 ½ B&W

military use on the eastern and western sections of the range, respectively. The BLM issues permits in response to applications for right-of-way easements or other non-military land uses. The USFWS is responsible for issuing permits for all land use on the Cabeza Prieta NWR.

The use of the airspace associated with the BMGR by civil aviation is generally prohibited because of air-to-ground training. The restricted airspace sections of the BMGR are established by FAA to contain and segregate activities that would be hazardous to other non-participating aircraft. Only aircraft scheduled to do so may enter active restricted airspace.

3.4.1 Land Status, Use, and Management Within the BMGR

Land Status

Land status is typically defined in terms of jurisdiction and/or ownership; however, P.L. 99-606 defines the status of the public lands within the BMGR, including the Cabeza Prieta NWR. In addition to BLM lands, the BMGR land withdrawal includes lands administered by the USFWS, Bureau of Reclamation (BOR), lands formerly under state jurisdiction, and private lands that have been purchased by the Air Force.

Cabeza Prieta NWR

Most of the Cabeza Prieta NWR has been a joint land use area since the BMGR was established during World War II. Creation of the range made the affected portion of the refuge available for certain military purposes but did not rescind its underlying purpose as a wildlife conservation area. Passage of P.L. 99-606, in effect, reaffirmed this dual land use status—military reservation, as well as wildlife refuge. The Cabeza Prieta NWR is comprised of 860,010 acres of which approximately 822,000 acres are within the BMGR. The non-military purpose of the Cabeza Prieta as a NWR is the conservation and development of natural wildlife and plant resources. As a component of the BMGR, the refuge lands and overlying low-level airspace support realistic, advanced aviation training in the interest of national defense. These overlapping conservation and defense training roles were reaffirmed and expanded in 1990 with the passage of the Arizona Desert Wilderness Act (P.L. 101-628), which designated 803,418 acres of the Cabeza Prieta NWR as federal wilderness (Figure 3-8). Almost all of the wilderness acreage is located within the BMGR withdrawal area. While designating wilderness, P.L. 101-628 also left intact the status of the Cabeza Prieta as a NWR, as a component of the BMGR, and as a location for limited low-level military flight training.

FIGURE 3-8
SPECIAL RESOURCE RECREATION, CONSERVATION, AND PROTECTION AREAS
WITHIN THE BMGR
11 X 17 B/W

Bureau of Reclamation

Lands owned and administered by the BOR exist in the northern portion of the BMGR, south of the community of Wellton. These parcels, totaling about 1,800 acres were acquired by the BOR in 1950. When acquired, these lands were considered to be public lands of the U.S. The 1962 legislative withdrawal withdrew and reserved all public lands in the area, including the BOR holdings, restricting their use.

State and Private Lands

While the current land withdrawal and reservation of the BMGR (P.L. 99-606) was predominantly public land, 81,000 acres of state land and approximately 2,675 acres of private land (University of Arizona 1986) were also included within the range boundary. Since the 1986 withdrawal, the Air Force has acquired all private lands within the BMGR through fee simple purchase (San Felipe 1997). In March 1998, a Declaration of Taking was filed in Federal Court, together with \$10 million, for the Air Force to acquire all fee and mineral interests in lands belonging to the State of Arizona lying within the BMGR boundaries. As a result, there are no longer state or private lands within the BMGR. Because the BMGR is managed as a whole unit, these parcels of land acquired by the Air Force are managed in the same manner as other withdrawn land.

Land Use

Current non-military users of the range include the BLM, USFWS, U.S. Border Patrol, U.S. Customs Service, AGFD, various utilities, educational institutions, and the public. Non-military land uses of the range include recreation, international border surveillance, utility rights-of-way, and natural and cultural resource management. Recreation use of the BMGR is discussed in detail in Section 3.11.

Land Management

P.L. 99-606 states that the Secretary of the Interior shall manage non-military use of the non-Cabeza Prieta NWR portion of the BMGR pursuant to the Federal Land Policy and Management Act (FLPMA) and the Recreation Use and Wildlife Areas Act of 1962 (16 U.S.C. 460k et seq.) The Air Force and Marine Corps must also participate in the management of non-military land use because of public safety considerations. Non-military use is managed by rules and regulations established to prevent interference with military training missions, protect public health and safety, reduce federal liability, and protect and preserve the natural and cultural resources of the range. The following discussion addresses the current BLM, USFWS, Air Force, and Marine Corps management policies for non-military use of the BMGR.

Bureau of Land Management

In 1990, the BLM completed preparation of the Lower Gila South Resource Management Plan (RMP) Goldwater Amendment in accordance 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 1990).

The RMP created the following major action plans for BLM management of non-military land use:

- # consider exchanges of state and private lands within the BMGR for public lands outside of the BMGR
- # complete all necessary field examinations and environmental assessments for any lease, right-of-way, temporary use permits, or other allowable non-military land uses
- # restrict construction of overhead transmission lines to alignments immediately parallel to the existing Gila Bend to Ajo 69kV transmission line
- # restrict underground facilities to the west of and parallel to the Tucson Cornelia and Gila Bend railroad
- # assure authorized land uses do not interfere with current or planned military use of the BMGR
- # designate preservation and recreation management areas within the BMGR (discussed in the section below)

Land Designations

The most significant land use management action in the RMP was the designation of preservation and recreation management areas within the BMGR (Figures 3-8 and 3-9). The ROD to the RMP designated 218,000 acres of the BMGR as Areas of Critical Environmental Concern (ACECs) and 103,920 acres as Special Recreation Management Areas (SRMAs). The ROD also designated 84,500 acres as Habitat Management Areas (HMAs) and established 19,200 acres of El Camino del Diablo (a road listed on the National Register of Historic Places) as a Backcountry Byway. These land management distinctions are designated by the BLM and apply only to the BMGR lands under BLM administration.

ACECs are authorized by FLPMA, and are designated through the BLM's resource management planning process as areas "within the public lands where special management attention is

FIGURE 3-9
EXISTING AND PROPOSED YUMA DESERT AND SAND DUNES HABITAT
MANAGEMENT AREA
11 X 8 ½ B/W

required to protect and prevent irreparable damage to important historic, cultural, or scenic values, fish and wildlife resources, or other natural systems or processes, or to protect life and safety from natural hazards.” SRMAs are recognized as containing resources of potential value to recreation, but do not meet the criteria for designation as an ACEC. The RMP designated two SRMAs within the BMGR. HMAs are areas recognized for their wildlife and botanical resources, but do not meet the criteria to be designated as an ACEC. Backcountry Byways are scenic corridors that pass through areas with scenic, natural, historic, and/or prehistoric values. The RMP contained specifications regarding acreage and resource qualities for BMGR areas designated as preservation or recreation management areas (Table 3-8). The RMP also contained management prescriptions for each of these areas. The management prescriptions, which are the most protective for the ACECs, primarily address resource protection, and include:

- # encourage military ground training activities to remain within current use areas
- # limit vehicle use to designated roads
- # reclaim areas of surface disturbance
- # manage recreation use by prohibiting woodcutting and establishing interpretive facilities
- # prohibit new rights-of-way or other types of new land uses
- # establish long-term natural resource study plots

The HMA is afforded much of the same protection as the ACECs; however, more emphasis is placed on protection of flat-tailed horned lizard habitat and less on managing recreation use. For SRMAs the management prescriptions primarily addressed recreation management and include:

- # limit vehicle use to designated roads
- # establish interpretive facilities
- # prohibit new rights-of-way and limit potentially adverse visual impacts associated with the development of existing utility corridors

Both SRMAs are located in areas with potential safety conflicts between recreation use and military use. The Sentinel Plain Lava Flow SRMA’s 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 limited. The Crater Range SRMA’s position adjacent to Manned Ranges 1 and 2 and North TAC has prevented the encouragement of recreation use in this area (U.S. DoD, Luke AFB 1997). While these military uses existed when the SRMAs were initially designated, public safety and liability concerns have increased over the years, particularly with the growing use of the BMGR for recreational purposes. As a consequence, the Air Force has re-evaluated its policy regarding public access to these two SRMAs and has restricted (but not eliminated) access to the Sentinel Plain Lava Flow SRMA and to the portion of the Crater Range SRMA that is west of State Route 85.

TABLE 3-8			
SPECIFICATIONS FOR BUREAU OF LAND MANAGEMENT DESIGNATED PRESERVATION AND 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	# 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	# designated to preserve flat-tailed horned lizard habitat (Figure 3-9) # Flat-tailed Horned Lizard Rangelwide Management Strategy increased this HMA to 131,200 acres (Flat-tailed Horned Lizard Working Group to Interagency Coordinating Committee 1997)
Backcountry Byway	El Camino del Diablo (proposed for designation)	19,200	# includes the portion of the rough, historic route used for travel across southern Arizona and portions of Sonora, Mexico # emerges from the western boundary of the Cabeza Prieta NWR and diverges into an east/west route extending one-quarter mile on each side of this portion of the route # 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 (Henry 1997)
Source: U.S. DOI, BLM 1990			

The management prescriptions for El Camino del Diablo Backcountry Byway include:

- # prohibit firewood collection within 150 feet of the corridor
- # establish interpretative facilities
- # reclaim areas of surface disturbance along the route
- # limit new rights-of-way or other types of new land use
- # permit vehicle-based camping only within 50 feet of the road unless otherwise posted
- # require a four-wheel drive vehicle for driving this road within the Cabeza Prieta NWR

U.S. Fish and Wildlife Service

The USFWS is responsible for the administration and land management of the Cabeza Prieta NWR. Currently managed under a broad set of goals and objectives, the refuge released the Draft Environmental Assessment (EA) for a comprehensive management plan for the refuge in April 1997. The EA presents seven general goals for the refuge for the next 20 years (U.S. DOI, USFWS 1997). The refuge goals are:

1. *Habitat and wildlife management*: to protect, maintain and restore the natural diversity of the Sonoran Desert represented in refuge lands.
2. *Childs Mountain Management*: to reduce the “footprint” of modern development on the mountain summit in the short term and eventually reclaim the summit for wildlife management purposes within a 30- to 50-year time frame.
3. *Wilderness/non-wilderness public access and recreational opportunities*: to provide reasonable levels of access to visitors that result in a better appreciation and understanding of the plant, animal, and wilderness resources of the refuge, and to provide visitors with compatible, high quality, safe, wholesome, and enjoyable wildlife-dependent recreational experiences.
4. *Cultural resources*: to protect, maintain, and plan for the cultural resources on the refuge for the benefit of present and future generations.
5. *Environmental education and interpretation*: to implement educational and interpretive initiatives that enhance the public’s understanding of the refuge.
6. *Cooperation with other governmental jurisdictions*: to strengthen interagency and jurisdictional relationships in order to coordinate efforts with respect to refuge and surrounding area issues.
7. *Refuge administration and staffing*: to have effective staffing and funding for refuge management activities.

U.S. Border Patrol

The primary responsibilities of the U.S. Border Patrol, a unit of the Immigration and Naturalization Service, is to prevent undocumented aliens from illegally entering the United States and to apprehend aliens who have already entered the country illegally. The Border Patrol conducts ground and aerial reconnaissance, including the use of noise and motion sensors, listening posts, observation posts, ground surveillance radar, and ground and air patrols. In addition, the Border Patrol creates and maintains roads that are periodically cleared of tracks, typically by dragging tires over the roads. These “drag roads” aid in the observation of footprints of illegal aliens traveling northward across the BMGR.

Air Force

Areas A, B, C, and D are Air Force management areas where non-military use most frequently occurs (see Figure 3-8). Areas A and B are non-target/non-munitions impact areas that are most commonly used for recreation. Area C may be used for recreation when there are no military deployments scheduled for AUX-6. Area D may be used for recreation only when BMGR air-to-air gunnery missions are not scheduled. Aerial gunnery may require the tow aircraft to release an aerial tow target at Area D. Area D is the designated, preferred drop site for aerial targets that the tow aircraft must release. The Range Operations Control Center (ROCC) maintains and monitors aerial gunnery mission schedules and must be contacted for permission to enter Area D (Mendez 1997).

Manned and tactical ranges are not open to public entry. Other areas of the BMGR from State Route 85 west to the Mohawk Mountains, including the Sentinel Plain Lava Flow SRMA and Crater Range SRMA, can be opened for public access on a very limited basis due to operational and safety constraints. The ROCC may be contacted for limited permission to access these areas during the few times when no military operations are scheduled.

Marine Corps

Permitted non-military use can regularly occur in a significant portion of the western section of the BMGR west of the Mohawk Mountains and east of the Gila and Tinajas Altas mountain ranges (see Figure 2-1, Area 14). As explained in Section 2.2.2, military use does not require the full-time restriction of public access to this area. Areas frequently visited by recreationists on the western section of the BMGR include the Baker Peaks pavilion area, Fortuna Mine, Tinajas Altas ACEC, and portions of El Camino del Diablo.

Arizona Game and Fish Department

Although the AGFD does not manage land, the agency is responsible for managing the state’s wildlife resources. Some of the activities conducted by AGFD on the BMGR include developing

or enhancing water catchments for wildlife and monitoring the health and population of wildlife species such as the Sonoran pronghorn and bighorn sheep.

3.4.2 Perimeter Land Jurisdiction and Use

Lands along the perimeter of the BMGR within five miles of the withdrawal boundary are described in this section in terms of land status or jurisdiction, existing land use, zoning, and future land use.

Land Status

Land status depicts the limits of administrative or jurisdictional control maintained by the major landholders located along the BMGR perimeter. Land status designations are important because they influence or directly determine such things as land ownership, agency jurisdiction, expenditure of management funds, and basic land and resource management.

Lands along the perimeter of the BMGR are located within Mexico and the state of Arizona. In Mexico, the lands within five miles of the BMGR boundary are primarily undeveloped native desert lands. No land use plans for this area were identified. Consequently, land jurisdiction and use data are not included for the study area within Mexico. In Arizona, the BMGR and surrounding area encompasses portions of three counties: Yuma, Maricopa, and Pima. Incorporated communities within the five-mile perimeter study area include Yuma, Wellton, and Gila Bend. Figure 3-10 depicts the private, state, and federal lands that occur adjacent to the range. Federal lands are administered by the BLM, USFWS, National Park Service (NPS), and the Bureau of Reclamation (BOR). The primary land management agencies or groups adjacent to the BMGR include the following.

*Bureau of Land Management*XManagement authorization for lands administered by the BLM stems from the Federal Land Policy and Management Act of 1976 (FLPMA) and calls for principles of multiple use and sustained yield in accordance with developed land use plans. The BLM is the single largest jurisdictional entity in the immediate vicinity of the range. The Phoenix Field Office administers the majority of these BLM administered lands. 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.

FIGURE 3-10
LAND STATUS ADJACENT TO THE BMGR
11 X 17 COLOR

*U.S. Fish and Wildlife Service (U.S. Department of the Interior)*XThe USFWS is responsible for improving and monitoring fish and wildlife resources by proper management of migratory birds and other wildlife. The organization is responsible for administering the Endangered Species Act of 1973. The USFWS administers the Cabeza Prieta NWR, including about 39,000 acres of land located outside of the BMGR.

*National Park Service (U.S. Department of the Interior)*XIn an Act signed in 1916, Congress established the NPS to promote and regulate the use of the federal areas known as national parks, monuments, and reservations. The NPS manages and administers unique land areas withdrawn from the public domain to conserve and protect scenery, natural and historic objects, archaeological resources, and fish and wildlife.

*Bureau of Reclamation*XThis category primarily includes BLM lands withdrawn for flood control and irrigation purposes. The BOR, formerly known as the U.S. Water and Power Resource Service, was formed in 1902 primarily to help develop and sustain the economy of the west by providing reliable water and energy supplies. BOR's mission and responsibilities now encompass a wide range of water resource management efforts, including electric power generation, municipal and industrial water supplies, irrigation water for agriculture, flood control, outdoor recreation, and enhancement of fish and wildlife habitats. 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 – Indian reservations include Indian trust land or tribal land. Title of land designated “reservations” is vested in the federal government, while the rights to use the land rest with the tribal members. Management of the land is in the hands of the tribal councils. Native American lands that fall within the range perimeter study area include the Tohono O’odham Nation. This reservation land, or Tribal Trust land, is administered by the Tohono O’odham Tribal Council and political subdivision of the Tohono O’odham Nation called Districts. The lands within three of these Districts fall within the study areaXthe Hicikiwan District and Sif Oidak District located east of the BMGR and the San Lucy District located near Gila Bend.

*State Trust Lands*XThe Arizona State Land Department administers lands to generate revenues for state-funded programs and infrastructure such as schools, medical and emergency services, and highways. Arizona State Trust Lands are under the jurisdiction of the Arizona State Land Department and represent lands held in trust to generate revenues for Arizona schools. These lands are located throughout the northern and western portions of the project area, with the biggest blocks located near the communities of Gila Bend, Dateland, and Yuma. Many of these State lands are leased for a variety of purposes, including agricultural production, grazing, or commercial and industrial uses.

*Incorporated Areas*XThis category includes incorporated communities, delineated by the corporate boundaries of cities and towns. Under authority delegated by the state, local governments exercise control over the development of land within incorporated boundaries

through planning, zoning, and subdivision ordinances, and engage in long-range comprehensive planning. In addition, these local governments are empowered to annex adjoining unincorporated land. 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 population of more than 60,000. Wellton has a population of about 1,200 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.

*Private and Other*XThis subcategory includes all land in the study area not otherwise jurisdictionally designated in one of the categories described above. These areas include small rural communities, dispersed private lands, and lands owned by local governments or school districts. Unincorporated areas typically fall under the jurisdiction of counties. Arizona counties within the perimeter study area for this project include Yuma, Maricopa, and Pima counties. In Yuma County, private lands are located in the vicinity of the city of Yuma and near Wellton. Yuma County administers unincorporated private lands (i.e. lands not within city boundaries) in these areas. A large block of private lands is also located near the community of Gila Bend. Maricopa County administers unincorporated private lands in this area. Private lands located in the vicinity of Ajo are administered by Pima County.

Existing Land Use

The primary land uses within the project area include urban mixed-use areas; agriculture; livestock grazing; rural residential; and lands designated for recreation, protection, or conservation. Existing land use inventory results for lands adjacent to the BMGR, with the exception of grazing allotments and linear features, are displayed on Figure 3-11.

*Residential*XThis category 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. Residential land uses within the perimeter study area are typically associated with incorporated and unincorporated communities, seasonal residences, agricultural facilities, and rural ranches. The vast majority of residential use within the study area is within the communities of Yuma, Wellton, Gila Bend, and Ajo. In the vicinity of Yuma, residential development primarily consists of subdivisions for single-family dwelling units, manufactured homes, or recreational vehicles. Although not formally a part of the city of Yuma, the Foothills area east of Yuma along Interstate 8 is a rapidly growing residential area also consisting primarily of a mixture of single-family homes, manufactured homes, and recreational vehicles. Residential use in the Wellton area can be characterized as low-density dwelling units

FIGURE 3-11
EXISTING LAND USE ADJACENT TO THE BMGR
11 X 17 COLOR

within agricultural areas, older single-family subdivisions, and, more recently, by a mixture of single-family, manufactured homes, and recreational vehicles. Residential land use in Gila Bend and Ajo primarily consists of older single-family houses in established subdivisions, with other dispersed mobile homes and single-family dwelling units.

Other places where 20 or more residences are concentrated within the vicinity of the BMGR include Tacna, Dateland, Sentinel, Paloma Ranch, San Lucy Village (San Lucy District of the Tohono O'odham Nation; north of Gila Bend), and Kaka (Tohono O'odham Nation). In addition, the Oasis Recreational Vehicle Park is located about two miles west of Dateland. Other low-density residential use is associated with agricultural lands that are scattered throughout the private lands within the perimeter study area.

*Public and Quasi Public*XThe public and quasi-public category includes schools, churches, cemeteries, airports and airfields, and other land uses generally associated with public use. The majority of these uses typically occur in urban and suburban areas within the perimeter study area, although some of these government functions or facilities are located in the smaller communities within the study area.

Several elementary schools and one junior high school exist within the 5-mile perimeter study area encompassing Yuma, as does the campus of Arizona Western College, which is shared by Northern Arizona University in Yuma. The Yuma County Fairgrounds, Yuma Conservation Garden, and several parks and churches are located in the study area. The Yuma International Airport is a joint use facility with MCAS Yuma.

One elementary school, one high school, and several parks are located in the Wellton area. Public and quasi-public land uses within Gila Bend 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. Public and quasi-public land uses within Ajo include an elementary, junior high, and high school; an outpatient clinic; several public parks; a library; several churches; and the Ajo Municipal Airport. Schools are also located in Tacna, Dateland, and Sentinel, and a community center is located in Dateland.

*Commercial*XCommercial land uses adjacent to the BMGR are primarily associated with the urbanized and agricultural centers along the principal travel corridors in the region and include Yuma, Wellton, Tacna, Dateland, Gila Bend, and Ajo. Commercial uses occurring adjacent to the range include service stations, hotels, restaurants, grocery and souvenir stores, and other related service businesses.

*Industrial*XIndustrial land uses adjacent to the BMGR are primarily associated with the urbanized and agricultural centers in the study area. Industrial uses include warehouses, light- and heavy-manufacturing plants, processing plants, electrical substations, landfills, and junkyards. The most common industrial land uses in the perimeter study area are active or

abandoned extraction areas (gravel pits) and borrow pits and uses associated with agricultural production.

Large industrial land uses adjacent to the BMGR include: (1) the Phelps Dodge Ajo Incorporated (PDAI) Mine in Ajo; (2) the Gila Bend Regional Landfill; (3) the Copper Mountain Landfill near Wellton; (4) electrical substations west of Gila Bend (the Gila Bend Substation) and just east of Yuma (the North Gila and Gila substations); and (5) an automobile testing facility operated by Ford, located near Tacna.

Mixed-use Area Mixed-use areas within the perimeter study area are associated with the communities of Yuma, Tacna, Gila Bend, and Ajo. These areas include a combination of commercial, industrial, and residential land uses.

Agriculture This category includes mechanically irrigated, flood irrigated, out-of-production agricultural areas, stockyards, and other agriculturally related uses such as production and warehousing facilities. Most agricultural areas have associated residential use. Other activities that typically take place within agricultural areas include storage, processing, and equipment maintenance. Agricultural land uses are found along the BMGR perimeter, nearly surrounding the BMGR's northern, eastern, and western boundaries. Irrigated cropland and orchards encompass approximately 92,700 acres within the perimeter study area. Irrigated croplands and orchards occur primarily in Yuma County along the western and northern borders of the BMGR, in conjunction with the agricultural corridors of the Gila and Colorado rivers. Primary crops include citrus, cotton, vegetables, and small grains. The other large agricultural area in the perimeter study area is west of Gila Bend, much of which is associated with Paloma Ranch. Primary crops in this area are cotton and small grains. In this same area in the vicinity of Gila Bend, large areas of land were previously cultivated, but now are out of production. In the vicinity of Dateland, there are large parcels of land, which consist of unmaintained jojoba fields. In the vicinity of Paloma Ranch, just south of Interstate 8, are abandoned stockyards. A large active stockyard operation is located immediately east of Wellton.

Range Land and Grazing Livestock grazing occurs throughout the perimeter study area, primarily on open rangelands administered by the BLM east of Dateland. Twelve grazing allotments are located on federal lands adjacent to the BMGR. In addition, several smaller grazing leases exist on lands leased from the state of Arizona, including two leases east of Dateland and land immediately east of Gila Bend.

Recreation, Conservation, and Protection Areas Recreation, conservation, and protection areas include areas, sites, or facilities used for recreational purposes or formally designated by a governmental agency for conservation or protection purposes. Along the perimeter of the BMGR, these areas and sites include the Cabeza Prieta NWR; Organ Pipe Cactus National Monument; designated wilderness areas; Areas of Critical Environmental Concern (ACECs); and dispersed recreation use, including off-road vehicle use and hunting. More detailed information about the recreation, conservation, and protection environment is provided in Section 3.11.

Zoning

County and local zoning of lands was inventoried and mapped for all private lands within the five-mile-wide perimeter study area. 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. In the case of the lands adjacent to the BMGR, land use zoning has been implemented for Yuma, Maricopa, and Pima counties and for the city of Yuma and the town of Gila Bend.

Within the communities of Yuma, Gila Bend, and Ajo, lands are primarily zoned as residential, commercial, industrial, and agricultural. Outside of these communities, zoning is primarily low-density residential, agricultural, and rural. The vast majority of the perimeter study area is zoned as rural or agricultural.

Future Land Use

Planned Land Use Planned land use category information was obtained from general or comprehensive plans adopted by each federal, state, county, and municipal agency. The planning efforts and information available for the BLM field offices, the state of Arizona, the three counties, and various incorporated and unincorporated cities and towns represent short- and long-term goals and expectations, but vary significantly in complexity and level of accuracy.

Resource management plans for the BLM Yuma District (1985) and Lower Gila South Resource Area (1985) were analyzed to identify major management prescriptions on federal lands. The draft Cabeza Prieta NWR Comprehensive Management Plan (1997) describes overall management issues within the refuge, including future development potential. A General Management Plan (1997) was also analyzed to identify planned land uses in the Organ Pipe Cactus National Monument. The Tohono O'odham Nation has no comprehensive plan for the entire reservation. The state of Arizona does not have a comprehensive management plan for lands in the vicinity of the range. On the local level, none of the three counties adjacent to the range—Yuma, Maricopa, and Pima—have current comprehensive or resource management plans covering the areas within the perimeter study area. The city and county of Yuma produced a Joint Land Use Plan for lands in the vicinity of MCAS Yuma (1996). The town of Gila Bend completed a General Plan in 1996.

Land use management prescriptions for the majority of federal lands west, north, and east of the BMGR are described in the Lower Gila South RMP and EIS (1985) and the Yuma District RMP and EIS (1985). The Lower Gila South RMP and EIS focus on rangeland management, wilderness, land tenure adjustments, and utility corridors within the area. The Yuma District RMP and EIS provide management prescriptions for lands adjacent to the BMGR. These prescriptions are that (1) some riparian areas along the Gila River are to be managed as priority wildlife areas, and (2) grazing management objectives should distribute livestock over the range to achieve more uniform forage utilization.

The primary management objective for the Cabeza Prieta NWR is wildlife habitat protection and

the enhancement of wildlife species. A secondary responsibility is the provision of wilderness and wildlife-oriented recreational opportunities. The final General Management Plan for Organ Pipe Cactus National Monument was completed and released in 1997. The primary goals described in the plan include adopting a regional perspective to improve visitor services and conserve resources, and improving management capabilities to enhance visitor opportunities and protect resources and wilderness values.

Municipalities with comprehensive plans or current planning guidance for areas adjacent to the range include Yuma and Gila Bend. The Yuma Joint Land Use Plan was adopted in 1996 as an amendment to the respective city and county general plans. The Joint Use Plan was prepared to achieve: (1) a common “blueprint” of land uses and land use development policies for the future development of lands within the incorporated and unincorporated areas around the city of Yuma, and (2) a foundation for the compatibility of land use activities in the vicinity of the MCAS Yuma/Yuma International Airport.

Yuma County is currently considering the adoption of an off-range boundary easement. The boundary would extend outward from the BMGR boundary for one mile. Any future development that occurs within this area would be required to file disclosure statements, effectively informing property buyers of the existence of the range. In addition, Yuma County has formally adopted the land use compatibility recommendations that were provided in the AUX-2 Air Installation Compatible Use Zone (AICUZ) study, and will be requiring disclosure statements for properties that fall within the noise footprint of this study (see Section 3.6 for more information on the AICUZ study).

The General Plan for the town of Gila Bend describes the existing natural characteristics, existing land uses and existing zoning of the area. The General Plan provides a blueprint for development, revitalization, and growth within the town’s corporate limits and acts as a guide for decision making in Gila Bend.

Two other documents that have been produced that provide suggestions for land management of lands adjacent to the BMGR are the AICUZ studies produced for MCAS Yuma AUX-2 (1993) and the Gila Bend AFAF (1997). As part of a federal program for all military air installations, AICUZ studies analyze the potential noise and safety effects of aircraft operations, and provide recommendations for land uses that are within high noise exposure areas or accident potential zones. For AUX-2, relatively high levels of noise exposure extend off the BMGR to the west. The AICUZ study provides recommendations that residential use be restricted in these areas. In the area around the Gila Bend AFAF, relatively high noise exposure levels extend off the BMGR to an area immediately north and east of the range. Certain types of land uses in this area are not recommended, including residences and other high intensity uses.

*Proposed Land Use*XThe proposed land use subcategory discusses specific land development proposals that have been recorded by county or city land management agencies or those identified by Tohono O’Odham land management personnel. Proposed land uses along the BMGR perimeter include:

*Phelps Dodge Ajo Incorporated Mine*XThe Phelps Dodge Corporation proposes to resume mining operations at its Ajo, Arizona property in 1998. 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. The operation's mineral reserves are expected to last just over 10 years. As part of the proposed mining operations in Ajo, the historic Tucson, Cornelia, and Gila Bend Railroad has recently been upgraded for use during the construction and operation of the mine to haul concentrate when the concentrator is in operation.

*Yuma Area Service Highway*XThe Yuma Area Service Highway has been proposed by the Yuma Metropolitan Planning Organization to connect Interstate 8 and Business 8 with the city of San Luis and a new commercial port-of-entry east of San Luis at Avenue E. This proposed highway would be approximately 25 miles in length and would improve the transportation of trade and freight between the United States and Mexico. A portion of the most recent alignment being considered would be located on the westernmost portion of the BMGR, although 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.

*Potential Annexation Areas*XTwo potential areas of annexation have been identified within the perimeter study area. The first, involves the city of Yuma's proposal to annex 162 square miles of land, including about 100 square miles within the BMGR, south to the Mexico border. The annexation would encompass large tracts of federal and state land in the vicinity and would include land proposed for the Yuma Area Service Highway and the proposed commercial port-of-entry. The town of Gila Bend has expressed interest in annexing about 10 square miles of land south of Interstate 8 and immediately east of the BMGR boundary. If the town were to acquire administrative control of this land, the land would likely remain rural in nature (Stephani 1997).

*Residential Development in the Vicinity of the BMGR Boundary*XResidential development is occurring in the vicinity of the BMGR boundary primarily near the communities of Wellton and Yuma. Within or adjacent to the city of Yuma, two mixed use (residential and commercial) projects have been identified approximately two miles north of the BMGR boundary. The first proposal, known as Cielo Verde, consists of about 380 acres of recently annexed land proposed for a mixture of residential types. The second proposal is a master planned community, known as the Lakes at Yuma, consisting of about 1,537 acres. Also within Yuma, the subdivision known as Tierra Mesa has proposed to expand by about 250 residences. South of Yuma, residential growth is occurring along the western edge of the range, primarily in the form of recreational vehicle parks and low-density (2 to 5 acre) parcels.

In the Foothills area east of Yuma, one single-family subdivision and one recreational vehicle subdivision have been proposed. The Yuma East Estates No. 2 subdivision is comprised of about 150 single-family lots located south of Interstate 8 and west of Fortuna Road. The Fortuna de Oro Unit 2 Recreational Vehicle Park is comprised of about 500 recreational vehicle lots located north of Interstate 8 and east of Foothills Boulevard. East of the Gila Mountains, land south of Interstate 8 is being subdivided into 5-acre parcels.

The Tohono O'odham Nation. Although there are no formal plans or proposals for changes to land use within the perimeter study area on the Tohono O'odham Nation, several potential changes have been identified. The Hia C-ed O'odham are a nomadic group of O'odham who are seeking a land base within or outside of the current nation boundaries. Once the land base has been established, the Hia C-ed would become the twelfth district within the Nation. Other potential changes to land use on the Nation within the study area include the development of additional residential structures in the vicinity of Kaka and the potential resettlement of some areas and villages adjacent to the BMGR.

3.4.3 Civil Airspace

National Airspace System

The restricted areas, MOAs, ATCAAs, MTRs, and LATN areas within the BMGR region, together with surrounding areas of public use airspace, are part of the National Airspace System. The National Airspace System was created by Congress in 1958 to support airspace requirements for three major user groups: general aviation, commercial air carriers, and DoD. The National Airspace System is defined as:

The common network of U.S. airspace; air navigation facilities, equipment and services; airports or landing areas; aeronautical charts, information and services; rules, regulations, and procedures; technical information; and manpower and material. Included are system components shared jointly with the military.

One of the intents of the National Airspace System is to provide each user group an independent, yet equal, right of access to the national airspace. Equal access for all user groups is a goal that can be accommodated, but only over large geographic areas or at different time periods. All users cannot have access to the same airspace parcels at the same time if basic flight safety is to be achieved. The military use airspace within the BMGR region is a clear example of the airspace partitioning that is necessary to ensure the greatest practical level of flight safety. When activated, restricted airspace contains and segregates military activities that would be hazardous to non-participating aircraft. Non-active restricted airspace is released to the FAA Air Route Traffic Control Center (ARTCC) for civil air traffic use.

Alert areas, MOAs, ATCAA, and MTRs separate military aircraft performing visual flight activities of a near hazardous³⁹ nature from aircraft being flown under the IFR. These structures also serve to alert the aircrews of nonparticipating aircraft being operated under the VFR of the locations to which military flight activities are constrained. Alert areas, MOAs, and MTRs are joint-use airspace that can be used by VFR traffic at anytime; however, the aircrews of nonparticipating aircraft must share the responsibility to see and avoid other air traffic jointly with military aircrews. In reality, nonparticipating aircrews are strongly discouraged from using

³⁹ Near hazardous is a regulatory term used by the FAA to describe military flight activities, flown under VFR, which include abrupt changes in headings, altitude, and air speed and in some cases supersonic airspeeds (only in approved MOAs and ATCAAs). These flight activities are incompatible with the safe conduct of IFR flight.

active MOA or MTR airspace because of the increased see and avoid difficulty military flight activities impose on all users. Inactive MOAs and ATCAAs are released to the ARTCC for civil use. The ARTCC can also cancel active MOA or ATCAA airspace if necessary to carry peak civil air traffic loads. Such loads are often the result of air traffic delays or detours that are necessary because of inclement weather elsewhere.

Restricted airspace, alert areas, MOAs, ATCAAs, MTRs, and LATN areas were established in the BMGR region to support DoD's requirement for access to the National Airspace System for national defense purposes. General aviation and commercial air carriers are also served in this region by public use airspace that includes high-altitude jet routes, low-altitude federal airways, 27 public use civil airfields, and 37 charted private airfields.

Jet Routes

Jet routes are 8-NM-wide corridors designated to serve aircraft operations in the high altitude airspace structure from FL 180 (18,000 feet MSL) up to and including FL 450 (45,000 feet MSL). The route centerlines are defined by an extensive network of radio navigation aids (Figure 3-12). The jet route system is designed to facilitate efficient cross-country travel and provide linkages to major air terminals. Jet routes are located above MOAs (which terminate below 18,000 feet MSL) but do not penetrate restricted airspace that extends into the high altitude structure. An ATCAA is not a structural impediment to jet routes as the ARTCC can restrict ATCAA use to altitudes compatible with the civil traffic load or cancel the ATCAA, if necessary. The locations of the R-2301W, R-2301E, R-2304, and R-2305, Sells 1, Ruby 1, and Dome MOA/ATCAAs are fortunate as they are south of the east-west jet routes that link southern California with Arizona and the rest of the country.

Victor Routes

The low-altitude federal airway system (also referred to as Victor Routes) serves aircraft operations below 18,000 feet MSL (Figure 3-13). The low-altitude system is defined by the same network of radio navigation aids that establishes the jet route system. The individual routes are 8 NM wide. The floors of these routes vary from segment to segment depending on the altitudes necessary to provide clear reception of radio navigation signals and safe overflight clearance above the underlying terrain. For example, V66, which lies north of the BMGR, has designated minimum enroute altitudes of 6,500 and 8,000 feet MSL for different segments between Tucson and Gila Bend and of 4,000 feet MSL between Gila Bend and Yuma.

Low-altitude airways do not penetrate restricted airspace and generally do not penetrate MOAs. Those few that pass through MOA airspace (e.g., V66-202, V208, and V442) cannot carry IFR traffic when the MOA is active.

The importance of the BMGR region for civil air traffic is signified by a radar image of traffic on a single weekday in April 1997 (Figure 3-14). Apparent within this snapshot is the high volume of traffic that uses

the jet routes and low-altitude airways within the BMGR region. This traffic includes approaches and departures from the region's principal airfields, other regional traffic, and cross-country overflights. Traffic in and out of Phoenix Sky Harbor, Luke AFB, and Tucson are evident from the flight tracks.

Also evident is the flow of traffic around the region's restricted airspace, MOAs, and ATCAA. This effect is most pronounced for R-2301E, R-2305, R-2304, and the Sells MOA/ATCAA, but is also apparent within the Gladden-Bagdad and Outlaw-Jackal MOA/ATCAA complexes. Military traffic within these airspace areas is not depicted in Figure 3-14.

Airfields

Airfields within the BMGR region include nine single- or joint-use⁴⁰ military airfields and 64 charted⁴¹ public and private airfields. By a considerable margin, Phoenix Sky Harbor International Airport (IAP) is the busiest civil or military airfield in the region with more than half a million operations reported in 1996. Tucson IAP is the second busiest with half that number of reported operations of Sky Harbor, based on 1995 data. Other civil airfields in the Phoenix area with more than 100,000 operations annually include Chandler, Falcon Field, Glendale, and Williams Gateway. Ryan Field near Tucson also reports over 100,000 annual operations. MCAS Yuma had 242,000 operations in 1996 and Luke AFB had 225,000 operations in 1995.

⁴⁰ Single-use airfields are military or civilian. Joint-use airfields are military and civilian.

⁴¹ Charted means the airfield is depicted on the Phoenix VFR Terminal Area Chart or Phoenix Sectional Aeronautical Chart. Uncharted private airports are also located in the region.

FIGURE 3-12
HIGH-ALTITUDE JET ROUTES IN THE BMGR REGION
11 X 17 B&W

FIGURE 3-13
LOW-ALTITUDE FEDERAL AIRWAYS (VICTOR ROUTES)
IN THE BMGR
11 X 17 B&W

FIGURE 3-14
RADAR TRACKS OF OVERFLIGHTS, DEPARTURES, AND ARRIVALS
IN THE BMGR, PHOENIX, AND TUCSON REGION FOR 9 APRIL 1997
8 ½ x 11 B&W

Air traffic flow within the Yuma region is facilitated by an agreement between the approach control facility at MCAS Yuma and the FAA. MCAS Yuma provides ATC services for both the air station and Yuma IAP. MCAS Yuma Approach Control has been delegated authority by Los Angeles ARTCC to act as the controlling agency for approximately 2,000 square miles of airspace within the YTRC region. This airspace stretches from approximately 45 NM east to 30 NM west of MCAS Yuma and to approximately 50 NM north of the air station and includes altitudes from the surface to 23,000 feet MSL (specifically, FL 230). In addition, MCAS Yuma Approach Control is the primary airspace surveillance and aircraft control agency for the following airspace.

- | | |
|--------------------------|------------------------|
| # R-2301 West | # Dome MOA/ATCAA |
| # R-2306 A/B/C/D/E | # Abel North MOA/ATCAA |
| # R-2307 | # Abel South MOA/ATCAA |
| # R-2308 A/B/C | # Abel East MOA |
| # R-2507 North and South | # Abel Bravo MOA/ATCAA |
| # R-2512 | # Kane East MOA/ATCAA |
| | # Imperial ATCAA |

This delegated authority includes all associated ATC obligations, meaning that MCAS Yuma approach control executes both en route and terminal (at MCAS Yuma/Yuma IAP) ATC functions for all military and civilian flights within its area of responsibility. MCAS Yuma was assigned this authority to increase the efficiency with which air traffic in the local region could be handled. As a result, both military and civilian aviation enjoy a capacity for increased traffic volumes and enhanced flows into, out of, and through the area without loss of safety margins.

3.5 PUBLIC UTILITIES AND GROUND TRANSPORTATION

3.5.1 Introduction

Public utilities and ground transportation within and immediately adjacent to the BMGR are described in this section.

Utilities inventoried include electrical transmission lines, major pipelines (natural gas and petroleum), and canals. Transmission lines include lattice tower and wood-pole electrical transmission lines having a capacity of 115 kilovolts (kV) or greater (i.e., 230kV, 345kV, 500kV). Transmission lines less than 115kV were considered distribution or sub-transmission lines and are too numerous to be included in this inventory. Major natural gas and petroleum pipelines that are greater than 8 inches in diameter were inventoried. Primary canals used for residential and agricultural water distribution were also identified.

Ground transportation features are considered to be significant roads and highways, such as interstate freeways, federal highways, state highways, county and other major roads, and railroads. Interstate freeways 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 the Arizona Department of Transportation. 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 area adjacent to the BMGR that meet these criteria are depicted in Figure 3-15.

3.5.2 Public Utilities

Transmission Lines

Electrical transmission lines over 115kV adjacent to the BMGR include a San Diego Gas and Electric operated 500kV transmission line that extends from the northeast to the North Gila Substation east of Yuma. The line then continues to the west, north of Yuma. A San Diego Gas and Electric 161kV transmission line extends from the Gila Substation east of Yuma, roughly paralleling Interstate 8 through Telegraph Pass to the Wellton area. A Department of Energy 161kV transmission line extends from the Gila Substation east of Yuma, paralleling U.S. 95 to the north out of the study area.

The Ajo Improvement Company, a subsidiary of Phelps Dodge Corporation, is applying for a right-of-way grant for the construction and operation of a 230kV transmission line from Gila Bend to Ajo. The electrical demand is generated from the proposed reopening of the PDAI Mine. The line is being proposed to connect 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 transmission line and Arizona State Route 85.

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. According to the Arizona Public Service Company 10-year plan, the anticipated construction date of the line is 2005.

Pipelines

The majority of pipelines adjacent to the BMGR are distribution lines serving urban, mixed use, and rural residential developments. Major pipelines include both natural gas lines and petroleum lines. Natural gas pipelines located along the perimeter of the BMGR are generally operated and maintained by El Paso Natural Gas Company. Petroleum pipelines adjacent to the range are operated and maintained by Santa Fe Pacific Pipeline.

Existing natural gas pipelines in the Yuma area include a 12-inch pipeline about four miles north of the BMGR owned and operated by El Paso Natural Gas Company. El Paso Natural Gas and Southwest Gas share an 8-inch pipeline that extends from the Dome Valley along the Interstate 8

corridor for approximately nine miles to the Wellton area. In the Ajo area, El Paso Natural Gas owns and operates an 8-inch natural gas pipeline known as the Ajo to Casa Grande pipeline. Santa Fe Pacific Pipeline Company owns and operates two petroleum pipelines connecting the Phoenix area with California. These pipelines include a 20-inch pipeline that operates 24 hours per day and a 12-inch pipeline that is currently dormant. These pipelines generally parallel the Union Pacific Railroad along Interstate 8 to Wellton and then extend to the northeast out of the perimeter study area through the community of Hyder.

The El Paso Natural Gas company has proposed to construct a natural gas pipeline to serve one or more utilities in Baja California and southwest Arizona. The proposed route for this pipeline would be from the Yuma area, roughly paralleling the proposed Yuma Area Service Highway into Mexico. New right-of-way would need to be acquired for this pipeline. The pipeline would be about 30 inches in diameter and would require about a 50-foot right-of-way. El Paso Natural Gas Company withdrew its proposal to construct this pipeline about 1995. However, the company may re-propose the project at some time in the future.

Canals

Canals adjacent to the BMGR are associated with agricultural and urban areas, and are therefore primarily found in the vicinity of Yuma, Wellton, and Gila Bend. In Yuma, the primary canals are the Main Lateral and "A" Canal. The Main Lateral extends south from MCAS Yuma, about four miles from the BMGR. The "A" Canal 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.

3.5.3 Ground Transportation

Highways and Roads

Four subcategories of surface transportation within and adjacent to the BMGR have been identified, including: (1) Interstate highways, (2) Mexican highways, (3) State highways, and county/other roads.

FIGURE 3-15
Public Utilities and Ground Transportation Features in the BMGR Vicinity
11 X 17 B&W

For the most part, the area adjacent to the BMGR is 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 3-9 provides average daily traffic counts for transportation routes adjacent to the BMGR (see Figure 3-15).

TABLE 3-9	
TRAFFIC COUNTS FOR ROADS WITHIN PERIMETER STUDY AREA	
	Average Daily Traffic Counts
Interstate 8	
Yuma to Wellton	10,200
Wellton to Gila Bend	8,400
Gila Bend to Stanfield	4,000
U.S. 95	
Yuma to Araby Road	10,228
Araby Road to Fortuna Road	6,875
Mexico Route 2	Data not available
State Route 85	
Gila Bend to Ajo	2,100
County/Others	
County 11 th Street (Yuma 32 nd Street) east of Avenue 3E	13,140
Avenue 3E	6,630
County 16 th Street	2,338
Avenue B (south of County 14 th)	10,213
Araby Road (north of B-8)	5,780
County 14 th Street (east of 4 th Avenue)	2,953
Fortuna Road	9,123
Foothills Boulevard	10,040
Old U.S. 80 (Wellton)	3,600
Source: Arizona Department of Transportation, Yuma Metropolitan Planning Organization, 1997	

In the Yuma area, the proposed Yuma Area Service Highway would improve the transportation of trade and freight between the United States and Mexico.

The BLM is currently completing a GIS-based inventory of all roads on the BMGR in order to complete a transportation plan. The plan will designate vehicle routes through a public participation process and will enable the development of accurate road maps for both military and civilian users.

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, generally paralleling Interstate 8 along the northern perimeter of the BMGR, through Sentinel, Tacna, Wellton, and Yuma. The other Union Pacific Railroad line diverges from this line east of Wellton, and 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.

As part of the proposed mining operations in Ajo, the historic Tucson, Cornelia, and Gila Bend Railroad was recently upgraded for use during the construction and operation of the mine to haul concentrate when the concentrator is in operation.

3.6 NOISE

3.6.1 Introduction

Within the BMGR region, noise is generated by various military and non-military sources. The predominant source of noise on or in the vicinity of the range comes from military training activities including aircraft operations and munitions training. Noise is also generated by other military operations such as movement of vehicles on land or by rail and delivery of inert ordnance. Civilian actions, such as movement of vehicles on public roads or railways, construction operations, and overflight by commercial aircraft, also contribute to noise in the region.

The vast majority of noise from military operations is generated by subsonic and supersonic aircraft operations and explosive ordnance operations. In this section, noise from aircraft operations is analyzed within the various airspace units of the BMGR, including restricted airspace, MTRs, MOAs, a LATN, and for airfields within the BMGR. Blast noise is primarily associated with the detonation of “live” weapons made up of high-explosive materials. Although aircraft and explosive ordnance are not the only sources of noise on the BMGR, they are the most readily identifiable source of noise on the BMGR. Noise from other military sources and from civilian actions is considered to be relatively constant and insignificant within the context of average annual noise levels, and is therefore not considered in this analysis.

3.6.2 Primary Noise Metrics

Three primary noise metrics are used to assess existing noise conditions on or in the vicinity of the BMGR. Two metrics are used to model noise from aircraft operations and the other metric is used in modeling both blast noise from explosive ordnance operations and noise from supersonic flight operations.

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 by researchers in an attempt to represent the effects of noise on the environment. The basic noise metrics used in this EIS are the Day-Night Average Sound Level (abbreviated L_{dn}), Onset Rate Adjusted Monthly Day-Night Average Sound Level (abbreviated L_{dnmr}) and the C-Weighted Day-Night Average Sound Level (abbreviated CDNL).

The noise metric utilized for military aircraft operating at a fixed location, such as an airfield, is the Day-Night Average Sound Level (DNL, symbolized as L_{dn}). 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 been shown to also be applicable to infrequent events (Fields and Powell 1985) and to rural populations exposed to sporadic military aircraft noise (Stusnick et al. 1992; Stusnick et al. 1993). This noise metric has been used for assessing noise at the two primary airfields within the BMGR, including MCAS Yuma AUX-2 and Gila Bend AFAF.

The noise metric utilized for 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 A-weighted which denotes the adjustment of the frequency content of a noise event to represent the way in which the average human ear responds to the noise. Unless otherwise mentioned, all noise metrics are A-weighted. Both L_{dn} and L_{dnmr} sum the 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 cumulative metric represents the variations in the sound level heard. However, they both provide an excellent measure for comparing noise exposure when there are multiple aircraft noise events to be considered.

L_{dnmr} also accounts for the surprise or startle effect that results from a high-speed aircraft overflight by adding from 0 to 11 decibel (dB) penalty for the event, depending on the rate at which noise from the approaching aircraft increases. Further, an additional 10 dB is added to sound levels from nighttime aircraft operations (occurring between 10 p.m. and 7 a.m.) to take into account reduced background noise levels and increased sensitivity to noise at night. L_{dnmr} is also 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.

The third noise metric considered in this analysis is used for high-energy impulsive sounds, such as those produced by supersonic aircraft operations and high-explosive bomb bursts. This noise metric is referred to as the C-Weighted Day-Night Average Sound Level, abbreviated as CDNL and symbolized as L_{cdn} . This metric is used due to the significantly higher energy created at low frequencies by these noises than by typical aircraft operations. This low-frequency component, frequently heard as a rumble, can induce structural vibrations, which may generate additional annoyance to people, beyond the audibility of the sound created by the blast.

3.6.3 Methodologies for Predicting Noise

There are four primary noise models used to address noise from military operations in this LEIS-NOISEMAP, MR_NMAP, MOABOOM, and BNOISE. Analyses of aircraft noise exposures around airfield facilities have been 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 (powers, altitudes, and speeds) to calculate the noise exposure at many points on the ground around the facility. This model was used in assessing noise exposure in the vicinity of MCAS Yuma AUX-2 and is currently being used to assess noise exposure at Gila Bend AFAF.

Noise levels for subsonic military aircraft operations were computed using the Air Force's MR_NMAP computer program (Lucas and Calamia 1992). Within MOAs and ranges with no preferred flight tracks, MR_NMAP computes noise based on a uniform distribution of sorties within the airspace. For MTRs, MR_NMAP calculates noise levels based on centerline of the MTR navigation points. Aircraft operational data used for calculating noise levels include aircraft, hours of operation, power settings, speeds, duration, altitude profiles, and sorties. This approach results in the presentation of the highest L_{dnmr} values expected.

The third major noise model utilized is MOABOOM, which implements the L_{cdn} model (Wyle 1994). The purpose of this program is to plot elliptical L_{cdn} contours suitable for tracing onto maps which would be incorporated into environmental analyses.

BNOISE, the fourth model used in this LEIS, analyzes blast noise exposure created from activities such as the use of high explosive materials in "live" weapons. BNOISE produces C-weighted Day-Night Average Sound Level contours for military operations with impulsive noise sources. Input data required for modeling this activity includes the type of ordnance, the trinitrotoluene (TNT) equivalent of explosive charge, location of the detonation, and number of daytime and nighttime events occurring per year.

These computer programs provide a relative measure of change in noise levels due to military aircraft and weapons training operations when the calculations are made in a consistent manner. NOISEMAP, MR_NMAP, MOABOOM, and BNOISE allow for noise predictions without the actual implementation and noise monitoring of those actions. These models also have the flexibility of calculating sound levels at any specific point, so that noise impacts at representative locations can be obtained directly.

3.6.4 Noise Exposure for Individual Airspace Units on the BMGR

For noise associated with subsonic aircraft operations, typical flight data such as number of flight sorties, average height AGL, airspeed, and time of the 24-hour day during which operations are flown in specific airspace units were collected from existing documents. The data were then updated and validated for the representative period of FY1996 for all airspace units analyzed in this document. Noise levels associated with flight activity on the BMGR by individual area are summarized in Table 3-10.

In calculating time-average sound levels, the reliability of the results varies at lower noise levels as a result of increasing variability of individual aircraft sound levels at greater distances due to atmospheric effects on sound propagation and to the presence of other sources of noise. As a

result, all noise levels calculated to be less than 45 dB, are given the annotation “<45.” Time-average outdoor sound levels less than 45 dB are well below any currently accepted guidelines for aircraft noise incompatibility.

Military Training Route and Weapons Tactics Instructor Flight Operations

Flight operations within the 18 MTRs and 5 WTI flight corridors in the BMGR region (see Figure 1-4) occur at various altitudes, airspeeds, locations, and frequencies depending on the kind of training that is being conducted and the airspace available in which to conduct that training. The large majority of the aircraft utilizing these MTRs and WTI flight corridors are fighter type aircraft (Table 3-11) which generally utilize the airspace from 300 feet to 5,000 feet AGL for the majority of their flight activities on MTRs; however, other aircraft – helicopters, for example – fly as low as 50 feet AGL. The majority of the airspeeds along these routes are in excess of 250 knots (nautical miles per hour) indicated airspeed (KIAS), with some ranging up to 550 KIAS. Under these flight conditions, none of the MTRs or WTI flight corridors analyzed had noise levels above an L_{dnmr} value of 55 dB, and approximately half of the operations resulted in levels below 45 dB.

Restricted Airspace and Range Operations

Aircraft operations within the eastern section of the BMGR (including R-2301E, R-2304, and R-2305) consist of flight activities primarily involving F-16s and A-10s flying at altitudes as low as 100 feet AGL up to altitudes over 45,000 feet MSL and at airspeeds sometimes over 500 KIAS. Aircraft flown in these areas, including the F-16 and A-10, and their respective level of operation are provided in Tables 3-12 and 3-13. Examples of specific flight activities conducted on these ranges include air combat maneuvering at altitudes above 25,000 feet AGL between similar and dissimilar aircraft, flights of two or four aircraft flying low-altitude (200–5,000 feet AGL) bombing operations delivering inert weapons on tactical and conventional targets, and helicopters flying “nap of the earth” profiles for training in tactical navigation and avoidance of detection by enemy ground radar. While there are many models of rotary-wing aircraft that use the range, they account for less than 2 percent of the total range sorties.

**TABLE 3-10
MAXIMUM L_{dnmr} LEVELS FOR AIRCRAFT OPERATIONS IN
INDIVIDUAL BMGR AIRSPACE UNITS**

Manager	Airspace	Sub-Area	Maximum L_{dnmr} Level, dB
Air Force	MTR	VR-223	54
		VR-231	50
		VR-239	<45
		VR-241	46
		VR-242	<45
		VR-243	<45
		VR-244	<45
		VR-245	52
		VR-259	50
		VR-260	48
		VR-263	48
		VR-267	<45
		VR-268	<45
		VR-269	<45
	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-2304/2305	Range 3	54	
MOA	Sells MOA	<45	
LATN	Sells South LATN Area	<45	
	Sells North LATN Area	47	
Marine Corps	MTR	IR-218	No Data
		VR-1267	56
		VR-1267a	47
		VR-1268	<45
	R-2301E/W Cabeza Prieta National Wildlife Refuge Flight Corridors	Fixed-Wing 1	48
		Fixed-Wing 2	48
		Rotary-Wing 1	<45
		Rotary-Wing 2	<45
		Rotary-Wing 3	<45
	R-2301W	R-2301W (west of Gila Mtns.)	<45
		R-2301W (east of Gila Mtns.)	49
		Moving Sands/Cactus West	52
	MOA	Dome MOA	<45

TABLE 3-11
OPERATION LEVELS
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**TABLE 3-12
OPERATION LEVELS (Sorties) BY AIRCRAFT WITHIN
BMGR AIR-TO-GROUND RANGES FOR FY 96**

Aircraft	North TAC	East TAC	South TAC	Range 1	Range 2	Range 3	Range 4	Moving Sands	Cactus West	Total Sorties
A-10	2,403	3,155	2,245	1,300	1,181	955	905	X	X	12,144
AV-8	302	196	311	190	176	176	176	1,050	571	3,148
AH-1	174	341	72	6	X	29	X	82	112	816
AH-60	12	6	9	X	X	21	X	X	X	48
AH-64	12	230	9	X	X	X	X	X	X	251
B-1	6	X	7	X	X	X	X	X	X	13
CH-46	58	12	42	X	X	X	X	48	58	218
CH-53	20	6	14	X	X	X	X	X	X	40
EA-6	18	X	24	X	X	X	X	X	X	42
EC-130	52	6	206	8	X	19	X	X	X	291
F-14	121	X	122	10	X	X	X	234	217	704
F/A-18	552	146	636	183	164	170	164	431	382	2,828
F-5	125	43	184	59	51	51	51	X	X	564
F-111	8	X	10	X	X	X	X	X	X	18
F-117	86	88	156	X	X	X	X	X	X	330
F-15	48	X	165	X	X	X	X	X	X	213
F-16	7,009	2,859	7,789	3,323	3,431	866	2,997	X	X	28,274
Tornado	10	X	X	X	X	X	X	X	X	10
H-1	12	X	X	X	X	X	X	X	X	12
H-6	6	X	6	X	X	X	X	X	X	12
H-60	8	13	X	X	X	X	X	X	X	21
UH-1	23	X	23	X	X	X	X	16	14	76
UH-60	X	20	X	X	X	X	X	X	X	20
KC-135	X	X	6	X	X	X	X	X	X	6
Totals	11,065	7,121	12,036	5,079	5,003	2,287	4,293	1,861	1,354	

X indicates no sorties for this aircraft

TABLE 3-13 OPERATION LEVELS (Sorties) BY AIRCRAFT WITHIN R-2301E/W AIR-TO-AIR RANGES, MILITARY OPERATIONS AREAS, AND LOW ALTITUDE TACTICAL NAVIGATION AREAS FOR FY 96						
Aircraft Type	R-2301E	R-2301W	Sells MOA	Dome MOA	Sells LATN	Totals
A-10	141	X	2,018	X	12,017	14,176
F-16	12,507	205	11,109	196	X	24,017
AH-1	54	109	X	X	92	255
AH-60	7	X	X	X	8	15
AH-64	10	X	X	X	X	10
AV-8	371	2,053	108	413	108	3,053
B-1	5	X	X	X	X	5
CH-46	59	142	X	X	19	220
CH-49	4	X	X	X	X	4
CH-53	16	52	X	X	6	74
EA-6	16	X	7	X	7	30
EC-130	76	X	8	X	8	92
F-14	169	322	66	X	X	557
F-15	144	X	56	X	X	200
F/A-18	930	2,075	313	751	X	4,069
F-111	12	X	X	X	X	12
F-117	142	X	164	X	X	306
F-5	256	808	105	X	X	1,169
Tornado	12	X	3	X	3	18
H-1	12	X	X	X	X	12
H-6	9	X	X	X	X	9
H-60	5	X	X	X	X	5
KC-135	7	X	12	X	X	19
UH-1	22	58	X	X	14	94
KC-130/C-130	X	126	X	230	265	621
Totals	14,986	5,950	13,969	1,590	12,547	
Xindicates no sorties for this aircraft						

Noise levels on ranges on the eastern section of the BMGR vary from L_{dnmr} values of 58 dB on Range 1 to 62 dB on both North and South TAC ranges (see Table 3-10). North and South TAC have relatively high noise levels due to over 11,000 annual operations by mostly F-16 and A-10 aircraft. All the other ranges have noise levels of less than 60 dB with less than approximately 7,000 annual operations. The air-to-air operations in R-2301E produce the least noise, 49 dB, mostly because the majority of these operations are conducted within the air-to-air high range at altitudes between 25,000 and 50,000 feet MSL. At these altitudes, little of the noise produced actually propagates to the ground.

In the western section of the range, the Marine Corps conducts the majority of their range operations in R-2301W including the Moving Sands and Cactus West target complexes. The primary aircraft utilized by the Marines are F-18s and AV-8s (see Tables 3-12 and 3-13). The Marine Corps operations are similar in nature to the Air Force, including air-to-air engagements, low-altitude delivery of weapons, and helicopter “nap of the earth” operations. The majority of the flight operations were conducted between the hours of 7 a.m. and 10 p.m.

Noise generated as a result of Marine Corps range operations is less than that generated by Air Force aircraft operations on the eastern section of the BMGR because there are about half as many total operations. As a result, the corresponding L_{dnmr} levels are also smaller, 49 dB or less in R-2301W and 52 dB for the Cactus West and Moving Sands target complex (see Table 3-10). In general, more noise exists in the vicinity of the Cactus West and Moving Sands target complex 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.

Explosive Ordnance Operations

Explosive ordnance operations take place within East, North, and South TAC ranges on areas referred to as High Explosives (HE) hills. Ordnance delivery to these three HE hills is dropped exclusively during the period of 7 a.m. to 10 p.m. Ordnance used at these sites most typically includes MK-82s (a 500-pound bomb), and MK-84s (a 2,000-pound bomb). The MK-82s are used more than twice as frequently as MK-84s. Detonation of an MK-82 bomb releases less energy, and thus makes less noise, than does an MK-84.

Noise as a result of explosive ordnance activities on North, East, and South TAC ranges was calculated to have L_{cdn} levels of 88, 93, and 85 dB, respectively, at the center of each of these areas. These calculations were based on 1996 data on ordnance used at each of the ranges; however, ordnance delivered at each of the ranges may vary from year to year. The noise levels rapidly diminish with increasing distance. For example, within half a mile the levels are reduced by approximately 6 dB and within a mile they are further reduced a total of 15 dB. The area exposed to these levels of noise within the 62 dB L_{cdn} contour for East TAC is about 6,917 acres, with South and North TAC ranges exposing a smaller area.

Supersonic Operations

During normal air-to-air engagements in R-2301E, R-2301W, and Sells MOA aircraft generally remain subsonic, although they may exceed the speed of sound for short bursts of time during some engagements resulting in what is commonly known as a sonic boom. Approximately 5 percent of F-16 sorties in R-2301E and approximately 3.5 percent of F-16 sorties in the Sells MOA exceed the speed of sound. Similarly, supersonic flight operations occur in R-2301W, primarily by F/A-18 aircraft in the TACTS range. Approximately 5 percent of all F/A-18 flight operations attain supersonic airspeeds during a portion of a normal training operation. Supersonic flight might occur some 5-10 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 maintenance functional check flights, these flights occur above 30,000 feet MSL and were not modeled because the resulting sonic booms frequently do not propagate to the ground.

Noise resulting from supersonic aircraft operations is minimal for aircraft operations associated with the BMGR. Supersonic flight information associated with F-16 air combat maneuvering activities in the Air-to-Air High area of R-2301E is incomplete but is thought to average less than one flight per day and slightly more than one per day in the adjacent Sells MOA on an annual basis. Supersonic activities in R-2301W are typically flown at or above 10,000 feet AGL and would also 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} contour levels resulting from these operations would be less than 45 dB in both R-2301E and Sells MOA.

Impacts at ground level from supersonic flight activities can also be expressed in pounds per square foot (psf) of overpressure of a single event. For example, an F-16 flying at 10,000 feet AGL at Mach 1.3 would create an overpressure of 4.59 psf, which is considerably less than the overpressure experienced at a large-scale public fireworks display (Maglieri and Henderson 1973).

Military Operations Area Operations

Flight operations data for the Sells and Dome MOAs were assessed in a similar manner as for the MTRs. The major difference between MOAs and MTRs is that operations in MOAs are best represented as occurring “randomly” throughout the lateral and vertical boundaries of the airspace the majority of the time with flight occurring at altitudes above 3,000 feet AGL and sometimes as high as 18,000 feet MSL. Operations in both the Sells and Dome MOAs are generally limited to fighter type aircraft (see Table 3-13) traveling at airspeeds between 300 and 500 KIAS. Approximately 14,000 sorties were distributed within almost 4,400 square statute miles of the Sells MOA, and about 1,600 sorties were associated with the Dome MOA. Because of the flight altitudes and relatively few number of sorties, the L_{dnmr} levels for both Sells and Dome MOAs were calculated to be below 45 dB (see Table 3-10).

Low Altitude Tactical Navigation Area Operations

The Sells LATN area is used to conduct random visual flight rule low-altitude navigation training between 100 feet AGL and 1,500 feet AGL at airspeeds not to exceed 250 KIAS. The majority of the aircraft utilizing the Sells LATN area are relatively slower moving C-130s, A-10s, and helicopters. More than 95 percent of the total operations in the Sells LATN are conducted by A-10 aircraft (see Table 3-13), which spend the majority of time between 500 and 1,000 feet AGL. Although the altitudes at which the A-10 flies are relatively low, the A-10 is considerably quieter than most fighter aircraft. Furthermore, the Sells LATN contains over 5,600 square statute miles of area, resulting in the L_{dnmr} levels no higher than 47 dB associated with the Sells LATN (see Table 3-11).

3.6.5 Cumulative Noise Exposure from Military Operations in the BMGR Region

With the exception of the auxiliary airfields, cumulative L_{dnmr} contours of 55 dB and greater from aircraft operations are illustrated in Figure 3-16. These contours depict the noise impacts associated with all MOA, tactical range, manned range, MTR, WTI, and LATN flight activity within the region of the BMGR during 1996. Only where there is a relatively large concentration of operations does one find cumulative noise contours and even then, those noise levels are comparatively low, always less than 65 dB.

With the exception of noise exposure in the immediate vicinity of AUX-2 and that which is expected near the Gila Bend AFAF, North, South, and East TAC constitute the only areas within the BMGR where the annual average noise contours exceed 60 dB. The L_{dnmr} levels for Ranges 1, 2, 3, and 4, where concentrated flight activities occur against numerous tactical targets spread over relatively small areas, constitute the only other areas on the BMGR where annual noise contours of 55 dB and higher exist. These tactical and manned ranges may individually and cumulatively have noise levels that range up to 65 dB, but no higher.

There are no cumulative noise contours of 55 dB or greater associated with any of the MTRs or WTI corridors on the BMGR or with the LATN Area or MOAs. This is due primarily to the relatively few operations that occur in these airspace units on an annual basis.

FIGURE 3-16
NOISE CONTOURS FOR AUX-2
11 x 17 B&W

3.6.6 Noise Exposure for Airfield Facilities Within the BMGR

Both the Gila Bend AFAF and MCAS Yuma AUX-2 airfields are used to support operations that either cannot be conducted at primary airfields due to location, limited capacity, safety concerns, or because of operational requirements. AUX-2 supports operations from MCAS Yuma, and the aircraft utilizing this field are limited mostly to AV-8s, C-130s, and CH-46s. The major user of AUX-2 is the AV-8, which conducts 97 percent of the activity. Most AV-8 activity at AUX-2 involves field carrier landing practice (FCLP) operations which simulate landing on an aircraft carrier. FCLP operations are almost circular patterns often conducted at night with several aircraft at low altitude. 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. 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 boundary (Figure 3-17).

Gila Bend AFAF is maintained and operated primarily to support training involving F-16 and A-10 aircrews from Luke and Davis-Monthan AFBs and rotary-wing aircrews from ARNG as an outlying field for practicing traffic pattern and emergency simulated flameout (engine power loss) procedures. In addition, the field 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 range from more than 80 dB within the installation boundary to 65 dB northeast of the installation over private lands (Figure 3-18).

3.7 PUBLIC HEALTH AND SAFETY

3.7.1 Introduction

The public health and safety study area is determined by the geographic extent of military operations associated with the BMGR. In terms of air operations, the study area includes the restricted airspace (R-2301W, R-2301E, R2304, and R-2305) directly over the range, the Sells MOA/ATCAA to the east of the range, and the Dome MOA/ATCAA to the west of the range. The study area also includes the 18 MTRs that terminate within the BMGR and standard routes in the public use airspace routinely used by military aircraft en route to and from the BMGR and the military installations that use the BMGR. In terms of ground operations, the study area includes the BMGR and the highways used by military personnel going to and from the BMGR.

The BMGR is designed with safeguards to ensure the health and safety of the public and military personnel to the greatest extent practical. The location of the range is ideal for this purpose because it is remote and away from major population centers. The normal weather conditions of the range support safe year-round flying. The range includes a land area of 4,169 square miles. The associated restricted airspace covers a land area of 4,323 square miles, including most of the BMGR lands.

One of the primary purposes of the creation of the BMGR was to protect public health and safety. This includes the protection of children in accordance with Executive Order 13045, Protection of Children from Environmental Health Risks and Safety Risks, which addresses children's greater susceptibility to health and safety risks compared to adults. The BMGR provides 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.

The range also minimizes the risks to military personnel. Ground-based troops or aircraft that are not scheduled participants in a training or training support activity are excluded from range areas where such activities are occurring. In turn, personnel participating in a training event can focus their attention on safety and effectively performing their assigned tasks without fear that their actions will place non-participants at risk. This segregation of military training activities within a designated block of land and airspace also serves to prevent interference with the scheduling or performance of these activities.

By their very nature, military operations associated with the BMGR pose some level of hazard to both airspace and ground users. Combat aircrew training necessarily requires the use of aircraft in high performance, high stress maneuvers that pit aircraft against other aircraft or ground-based air defense systems. Training also demands realistic experience in employing air-to-ground bombing, gunnery, and rocket strikes against simulated enemy targets. Most training operations can be effectively performed without live fire or with live fire of inert (non-explosive) practice munitions. Some use of live (explosive) ordnance is required, however, to produce qualified air combat aircrews.

Examples of ground-based hazards on the BMGR from military activities include expended but unexploded ordnance, laser use, poor road conditions, and military vehicle traffic. Non-military hazards such as venomous wildlife and the risks of heat-related illnesses or hypothermia are also present.

3.7.2 Aviation Safety

Aircraft Mishaps

The restricted airspace structure of the BMGR and its sub-ranges was created and functions to provide safe separation between non-participating aircraft. Both the Air Force and the Marine

FIGURE 3-17
 L_{dn} NOISE CONTOURS FOR AUXILIARY FIELD 2
11 x 17 B&W

FIGURE 3-18
NOISE CONTOURS FOR GILA BEND AIR FORCE
AUXILIARY FIELD
8 ½ x 11 B&W

Corps have detailed scheduling and operating procedures that provide a second layer of protection against aircraft mishaps. Similarly, in the event of a mishap, the Air Force and Marine Corps each have plans detailing mishap response procedures.

The Luke AFB Supplement to Air Force Instruction (AFI) 13-212 provides specific safety instructions to users and operators for the eastern section of the BMGR. The RMO at Luke AFB is responsible for scheduling, authorizing, and coordinating all military and non-military air operations and activities on the eastern section of the range. All aircraft must be cleared through the ROCC at Gila Bend AFAF prior to entering or departing range airspace. Since 1988, there have been eight aircraft mishaps or incidents within the Gila Bend segment of the BMGR, resulting in four fatalities.

For the western (Marine Corps) section of the range, Station Order 3710.6H (range regulations for BMGR activities scheduled by MCAS Yuma), Station Order 3750.2 (Aviation Safety Program), and Station Order 3750.2D (Pre-mishap Plan) provide specific information to users and operators about safety on the Yuma segment of the BMGR. The Commanding Officer (through the Range Management Office) at MCAS Yuma is responsible for scheduling and authorizing all air operations within the Yuma segment of the range. Since 1991, there have been eight aircraft mishaps or incidents within the Yuma segment of the BMGR. One of these mishaps resulted in four fatalities.

The safety procedures described for the eastern and western sections of the range apply equally to air operations occurring over the Cabeza Prieta NWR. Additional procedures to follow in the event of an aircraft crash on the refuge are outlined in a 1994 MOU between the DoD and DOI. The procedures serve primarily to improve coordination and communication between the agencies.

Chaff and Flares

Chaff and flares are the principal defensive mechanism dispensed from military aircraft to avoid detection and/or attack by adversary air defense systems. Chaff consists of small fibers that reflect radar signals and, when dispensed in sufficient quantities from aircraft, forms a “cloud” that breaks the radar signal and temporarily hides the aircraft from radar detection. Flares provide high-temperature heat sources ejected from aircraft that mislead heat-sensitive or heat-seeking targeting systems. Chaff and flares are used to keep aircraft from being targeted by weapons such as surface-to-air missiles, anti-aircraft artillery, and other aircraft.

The effective use of chaff and flares in combat requires training and frequent use by aircrews to master the timing of deployment, the capabilities of the devices, and to ensure safe and efficient handling by ground crews.

Chaff and flare deployment throughout the BMGR airspace complex is governed by a series of regulations that are based on safety and environmental considerations and limitations. Among these regulations are the following:

- # AFI 13-201, which establishes practices to decrease disturbances from flight operations and protect the public from the hazards and effects associated with flight operations.
- # AFI 11-206 prohibits Air Force pilots from intentionally allowing any object to be dropped from an aircraft, except in an emergency, without prior approval. Approval is only given when the dropped object will not create a hazard to people, property, or other air traffic.
- # AFI 13-212, which outlines procedures governing weapons range use of chaff and flares.
- # AFI 11-214, which delineates procedures for chaff and flare employment.

Only two types of training chaff (RR-188 and RR-170) are authorized for use within R-2301E, R-2304, and R-2305. The use of RR-188 is authorized at or below FL 350 (35,000 feet MSL under standard atmospheric conditions) within R-2301E and at or below FL 240 (24,000 feet MSL under standard atmospheric conditions) within R-2304 and R-2305. RR-170 is authorized at or below FL 350 within R-2301E and at or below 5,000 feet AGL in R-2304 and R-2305. (Luke AFB Supplement 1 to AFI 13-212). Chaff is used similarly within R-2301W. In FY 1996, RR-188 was the only type of chaff used within R-2301W and it was the type used 90 percent of the time within R-2301E, R-2304, and R-2305 (see Table 3-4).

Chaff consists of very small fibers of aluminum-coated mica that reflect radar signals and, when dispensed from an aircraft, form a cloud that temporarily hides the aircraft from radar detection. Although the chaff may be ejected from an aircraft using a small pyrotechnic charge, the chaff itself is not explosive. Chaff is composed of silicon dioxide fibers ranging in diameter from 0.7 to 1 mil (thousandth of an inch), coated by an aluminum alloy and a slip coating of stearic acid (fat). Analyses of the materials comprising chaff indicate that they are generally non-toxic in the quantities used (U.S. DoD, Air Force 1997). Silicon dioxide is an abundant compound in nature that is prevalent in soils, rocks, and sands. The trace quantities of metals included in the mica fibers are not present in sufficient quantities to pose a health risk. Aluminum is one of the most abundant metals in the earth's crust and water. In general, aluminum is regarded as non-toxic. Trace quantities of silicon, iron, copper, manganese, magnesium, zinc, vanadium, or titanium may be found in the alloy. The quantities involved are a minuscule percentage of levels that might cause concern. Stearic acid is found naturally as a glyceride in animal fat and some vegetable oils. Chaff has also been test-fired in a controlled environment to determine its potential to break down into respirable particles (PM₁₀). The findings of the test detected no PM₁₀ (U.S. DoD, Air Force 1997).

Defensive flares consist of small pellets of highly flammable material that burn for a few seconds at extremely high temperatures. The purpose of defensive flares is to provide a heat source other than the aircraft's engine exhaust to mislead heat-sensitive or heat-seeking targeting systems and decoy them away from the aircraft.

A second type of flare—the illumination or parachute flare—is typically used on the Air Force manned and tactical ranges. These flares are used to illuminate targets for night training. The flares are normally released from aircraft at above 5,000 feet AGL. A parachute slows the decent of these flares in order to provide prolonged illumination of the target areas. Ignition of the flares is controlled by a preset altimeter to an altitude predetermined for each training mission. Illumination flares can burn for several minutes but are dropped from an altitude sufficient to allow them to burn out prior to hitting the ground.

3.7.3 Ground Safety

Eastern (Air Force) Section of the BMGR

The 56 FW, the host command at Luke AFB, is the administrative command for controlling all military activities on the eastern section of the BMGR. The 56 FW is responsible for determining if non-military activities on or proposed for the eastern section of the BMGR are compatible with military operations and for controlling all surface entry into the area. To satisfy these responsibilities and protect the health and safety of all users, specific procedures for controlled entry have been established. These procedures include a safety briefing and permit system; continuous scheduling and range access control; and gated and locked entry roads, perimeter fencing, and warning signs.

Any individual requiring or desiring access to any portion of the eastern section of the BMGR for military or non-military purposes currently receives a range safety briefing, which includes precautions that must be followed to avoid ordnance and environmental hazards of the range. The briefing includes a video session in which two videos are shown. One addresses the environmental and ordnance hazards of the range and the other addresses the natural and cultural resources of the range. All individuals must also complete an application for range entry acknowledging certain responsibilities and liabilities including the need to notify the range entry granting authority of the location and time of range ingress and egress. The application also acknowledges that each person may be held liable to pay for any or all expenses incurred for any search or other action deemed appropriate. Non-military visitors desiring to enter the range must sign a hold harmless agreement certifying that the visitor is aware of the hazards and is responsible for his or her own safety.

The ROCC maintains a master range schedule for all air and ground military and non-military operations and activities on the eastern section of the BMGR. Authorized access to the eastern section of the BMGR is controlled by the ROCC to ensure that there are no safety conflicts among multiple range users. Any military mission that has the potential to cause conflict with ground access is required to be posted on the master range schedule so that the ROCC can verify that there are no safety conflicts. Generally, there are no conflicts associated with entry into management areas A and B, which are non-target and non-munitions impact areas (Figure 3-19). These are the only locations within the eastern section of the range where the public is regularly granted access for recreational use. There are often safety conflicts associated with ground access

to manned, tactical, and air-to-air ranges. All military and civilian personnel, therefore, must obtain prior approval from the ROCC to access these areas.

The locations for legal entry on to the BMGR are limited. A barbed wire boundary fence is in place around the entire perimeter of the eastern section of the range with attached warning signs in English and Spanish posted approximately every 300 feet (Adams 1997). At legal entry locations, locked gates are posted with range entrance signs that identify the range, its administering agencies, and who and where to contact for entry procedures and permits. At interior locations in the BMGR there are also warning signs posted at entrance locations to manned ranges and tactical ranges. Approved entrance locations to tactical ranges can only be encountered after traveling through a manned range.

Manned Ranges

Safety hazards associated with the four manned ranges stem from the presence of aircraft operations, ordnance contamination, and road use. The BMGR manned ranges are well isolated from the risk of inadvertent entry to the surface danger portions of these ranges by unauthorized military personnel or members of the public. Locked gates, fences, and warning signs make accidental vehicular access from State Route 85 an improbable event. Range 4, however, is located near the northern BMGR boundary close to the Sentinel exit from Interstate 8. An unmaintained dirt road leads southeast from this exit to the west side of Range 4. This area of the BMGR perimeter is no longer well signed and there are no gates to deter unauthorized persons from entering. Portions of the Sentinel Plain Lava Flow SRMA are located within Range 4 and North TAC. SRMA designation is incompatible with Range 4 and North TAC hazards and operations. To protect public health and safety and to minimize liability risks, the Air Force restricts public entry to portions of the Sentinel Plain Lava Flow SRMA, and prohibits access to the manned and tactical ranges. Visitors to the eastern BMGR must always contact Gila Bend AFAF prior to entry to obtain current visitation information.

Ordnance use on the manned ranges is limited to training munitions, which do not contain explosive warheads but may contain a small signal cartridge. All ordnance intentionally expended on manned ranges must be delivered at approved targets. Ordnance may be found on or below the ground surface in off-target locations, however, as a result of inadvertent releases caused by faulty equipment or aircrew procedures. Low-angle strafe poses a risk that the bullets may ricochet from impact with the ground and strike aircraft or ground personnel. To reduce these hazards, the BMGR manned ranges have been placed in locations where the low-angle strafe targets are over soft, deep, alluvial soils with a high potential for reducing bullet velocities and trapping them. Adherence to manned range procedures keeps all ground personnel and aircrews out of the potential line of intentional or inadvertent fire.

Manned ranges are littered with training practice rockets, bombs, and gunnery bullets especially near bombing targets and down range of low-angle strafe targets. EOD personnel clear munitions from the surface of target areas on a routine basis, and from a much wider area of the range during the annual clean-up. Munitions that have become buried under the surface are not cleared.

In general, manned range operations on the BMGR are well controlled and have a good safety record. No ground personnel have been hurt or killed from weapons delivery operation on these ranges.

Tactical Ranges

The actions and conditions within BMGR TAC ranges with implications for the health and safety of ground personnel include air-to-ground live-fire training, munitions delivery, laser use for target designation, surface contamination with expended ordnance, target structures and support facilities, and road use. Live-fire training is the activity within BMGR TAC ranges with the most significant implications for the health and safety of ground personnel. A wide range of conventional ordnance is authorized for use on the TAC ranges and live munitions are authorized for use on five selected targets—one HE hill within each TAC range and one live Maverick target in both North and East TAC ranges. The potential for ground personnel to be injured or killed by air-to-ground delivery has been reduced by the tight controls placed on aircraft weapons use, range scheduling, and TAC range entry procedures by ground personnel. No public access to the TAC range is authorized. The security of the TAC ranges for live-fire training is bolstered by their relatively isolated location away from uncontrolled public use areas.

Each TAC range is equipped with complex arrays of simulated military targets. These targets do not generally constitute a hazard for personnel authorized to enter the TAC ranges, but might prove to be an attraction to members of the public if public visitation were authorized.

Other Ranges and Operations Areas

The air-to-air combat training range is a composite of four flight training areas with assigned airspace and land. Barring an aircraft crash, the jettisoning of aircraft equipment such as external fuel tanks, or the loss of aircraft structures such as antennas or access panels, air-to-air training that does not involve live fire poses no hazard to surface users. Munitions fired from within the primary air-to-air firing range will generally fall out within the underlying land area or within nearby BMGR lands. Military personnel and the public are excluded from the fall out surface area for air-to-air gunnery munitions or targets when military operations are scheduled.

FIGURE 3-19
MILITARY OPERATIONS AREAS, SPECIAL LAND MANAGEMENT
AREAS, AND ACCESS RESTRICTIONS
11 x 17 B&W

An AICUZ study was completed in 1997 for the Gila Bend AFAF, where aircrews are trained for in-flight emergency procedures. AICUZ studies describe areas of high noise levels and accident potential associated with air installations, and provide land use compatibility guidelines for these areas. Accident Potential zones (APZs), established for the AICUZ study, specify areas where various levels of safety concerns exist in the vicinity of the installation. At Gila Bend AFAF, the APZs extend off the BMGR to the northeast over primarily undeveloped land. Most residential and high-intensity land uses are not recommended on lands within the APZs. Ground entry to Gila Bend AFAF is controlled at all times.

AUX-6 is used for deployment training exercises. Public health and safety hazards due to military operations at AUX-6 are minimal because (1) training exercises are confined to the AUX-6 site, (2) there is no use of live ammunition or fixed-wing aircraft in training, and (3) the area is closed to public use during deployment exercises. (U.S. DoD, Department of the Air Force 1995a).

Areas A and B are non-target/non-munitions impact areas and are the most frequently used areas for recreation purposes (see Figure 3-19). There are minimal military hazards associated with these areas; however, the areas may have been used as target areas in the 1940s or 1950s resulting in the potential for contact with unexploded munitions. Air Force entry procedures provide visitors to Areas A and B with advisories of these potential hazards and of the hazards present in the adjacent East TAC range.

Western Portion of the BMGR

Military personnel requesting surface entry to the western section of the range must submit a request form specifying the number of personnel; the number and type of vehicles; ingress and egress routes; mode of transportation; exact location of personnel; and types and amounts of weapons, ordnance, and lasers (if applicable). Units setting up base camps and staying overnight must receive an environmental and safety briefing from MCAS Yuma Range Management personnel. Civilian personnel requesting entry into the western section of the range must adhere to the same requirements and, in addition, are required to sign a hold harmless agreement.

Public visitation is permissible throughout much of the western section of the BMGR, with the exception of the AUX-2 and Moving Sand and Cactus West target areas (see Figure 3-19). Public users of the range must contact the MCAS Yuma Range Management Office, sign a hold harmless agreement, and complete a range permit to gain access to areas of the western section that are open to public use. Users are expected to check on and off of the range with the Range Management Office.

Public access to the western section of the range is available at four locations on the northern boundary of the range off of Interstate 8. This area of the range is not fenced or gated. Entry warning signs including information on how to obtain an entry permit are posted at all road entrances. The restricted entry area associated with AUX-2 and the Moving Sands and Cactus West target complex is accessible along the western boundary of the range but is controlled by

fencing and warning signs. Access to this area is also available from the interior of the range from the east, but entry locations are posted with warning signs and public users are instructed not to enter the restricted area. Warning signs are posted at each of these interior entry locations.

Public entry is prohibited in the AUX-2 and Moving Sands/Cactus West areas because (1) the access road to the entire area is located within restricted areas; (2) a rifle range, EOD operating area, and parachute drop/cargo recovery zone are adjacent to the access road; (3) the target impact areas, range safety zones, and laser hazard area for the Moving Sands and Cactus West complex envelop most of the area from the R-2301W boundary east to the Gila Mountains; and (4) practice and inert ordnance located in the Moving Sands and Cactus West target areas may retain unexploded signal cartridges that, though small, are dangerous to any unauthorized person that should handle them. An annual exercise called HAWK FIREX requires that public access be closed for one weekend each year in the western section of the range from the Baker Peaks and Copper Mountains area east to the Mohawk Mountains; access to and from Cabeza Prieta NWR's north (or Tacna) entrance is also restricted. Other Marine Corps ground activities may require restrictions on public access to local ground support areas in which Marine troops and equipment are deployed. Visitors are generally barred from entering active ground support areas to protect the public from hazards associated with military vehicle traffic or portable radar transmitters and to prevent interference with training activities (U.S. DoD, MCAS Yuma 1997).

Training Ranges

Potential ground safety hazards associated with the Moving Sands or Cactus West target complex 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 the western section are provided with a range map that depicts this area as off-limits to public visitation (see Figure 3-19). 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 surface personnel. The transmitters are located within the target complexes well away from locations approved for public use. Live fire air-to-ground attack training at Moving Sands and Cactus West clearly presents the potential for a health and safety hazard for surface users. The exclusion of the public from target areas on a continuous basis, however, has effectively neutralized this potential for the public.

Tactical Aircrew Combat Training System

Current potential safety hazards associated with the TACTS range are related to transmitted microwave, radio, and radar energy from various TACTS instrument and emitter sites (see Figure 1-2). Physical and electronic barriers prevent energy transmission at all TACTS installations from contacting any surface locations where ground personnel could be exposed to a hazardous dose of radio frequency radiation. In addition, public access is restricted on a full-time basis to these sites and they are fenced, locked, and posted with hazard warning signs.

Other Ranges and Operations Areas

Other ranges and operation areas located within the BMGR include a rifle range, AUX-2, the Cannon Air Defense Complex, ground support areas, temporary communication sites, and a EOD operating area. The location of these ranges is depicted on Figure 1-2.

A 30-lane rifle range located within the BMGR near AUX-2 is used for small arms training by personnel stationed at MCAS Yuma. The surface danger zone of the rifle range is entirely contained within unoccupied portions of the BMGR that are closed to public access. MCAS Yuma is currently considering a proposal for a new pistol range adjacent to the existing rifle range.

AUX-2 supports MCAS Yuma based AV-8B squadrons in ship borne flight operations training, also known as FCLP. The Marine Corps is proposing to construct a new hard-surfaced runway/roadway at AUX-2 to support additional AV-8B training in using roads as ad hoc forward airfields (U.S. DoD, MCAS Yuma 1997). Accident potential zones have been developed at AUX-2 at each runway end and include the entire FCLP flight tract that extends west of the BMGR boundary. The airfield itself is off-limits to public access at all times due to its location in an access restriction area of the BMGR (see Figure 3-19).

The Cannon Air Defense Complex (formerly known as P1-11) is an outlying facility of MCAS Yuma located within the northwest corner of the BMGR that serves as the headquarters, training and maintenance site for the light anti-aircraft missile battalion stationed at Yuma. Simulated launches of the HAWK anti-aircraft missile system are a principal training activity at this site. No actual missiles are launched from this location and no restrictions are placed on other BMGR functions as a result of the activities at the Cannon Complex (U.S. DoD, MCAS Yuma 1997). Public access to the Cannon Complex is controlled by perimeter barriers and a guard station.

Some Marine Corps aviation training exercises require the deployment of ground troops that will play roles as friendly or hostile air defense and communications units to various locations on the BMGR that have tactical or logistical relevance to the training. Currently, there are 41 ground support areas in the western section of the range used principally during the WTI course to create a complex air-ground battlefield training scenario that includes land-based air control, air defense, electronic warfare, communication, and forward area helicopter refueling. WTI course

related surface hazards are associated with radio and microwave radiation from mobile radar and communication equipment and the use of military trucks to transport troops and equipment.

All surface hazards zones associated with the use of radar or communications equipment on the BMGR are identified with perimeter flagging and warning signs to keep all personnel clear of dangerous exposures of radio frequency radiation. The public is further protected by its temporary exclusion from the ground support areas in which military units and radar and communications equipment is deployed. Military truck traffic can be locally heavy near and to/from ground support areas used during WTI courses. Truck traffic can result in the short-term impairment of driving visibility due to fugitive dust on the BMGR dirt roads.

The Marine Corps continues active open burning and open detonation (OB/OD) treatment of expired shelf-life munitions under an interim Air Force Resource Conservation and Recovery Act (RCRA) permit for the BMGR with the Arizona Department of Environmental Quality (ADEQ). An estimated 6.5-square-mile area, off-limits to unauthorized access, surrounds the EOD operating area to keep military and civilian personnel clear of hazards when OB/OD operations are occurring.

Cabeza Prieta NWR

All individuals who wish to visit the Cabeza Prieta NWR must complete a refuge permit application and sign a BMGR hold harmless agreement. A Cabeza Prieta NWR entry permit allows visitors to travel through, without side trips or stops, the western section of the BMGR to or from Wellton or Tacna located off of Interstate 8. The refuge staff make an effort to advise all visitors of potential health and safety hazards when they apply for a permit at the refuge office in Ajo, Arizona. In addition, health and safety warnings are written on the permit.

Before and during World War II, the Air Force conducted air-to-ground training on the Cabeza Prieta NWR. After World War II, air-to-ground training on the refuge declined dramatically. In 1960, an MOU between the Air Force, Marine Corps/Navy, and USFWS suspended all air-to-ground training; however, air-to-air gunnery training continued over the refuge principally over the San Cristobal Valley area. Due in part to an MOU between the DoD and DOI signed in 1994, and a reduced requirement for live-fire gunnery training, no live-fire gunnery has taken place over the refuge within the last few years. Parts of the refuge are littered with dart tow targets that have fallen to the ground during past live-fire air-to-air training exercises. In a recent study, a sample of transects was analyzed to estimate the number of DARTs within the Cabeza Prieta NWR. That study reported that there are approximately 1,612 DARTs in the 466-square-mile refuge study area (DoD, Luke AFB 1998). Other military debris, such as inert .50 caliber and 20mm rounds, are also scattered throughout the refuge.

3.7.4 Non-military Hazards and Other Safety Issues

Environmental Hazards

There are a variety of environmental conditions on the range that could present serious hazards to visitors. The environmental features that could cause visitors problems include rugged terrain, remoteness, extreme temperatures, intense sunlight, lack of drinking water, flash floods, abandoned mines and wells, and venomous wildlife.

The mountain 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 distance 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 and military personnel 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 are scattered throughout the BMGR. These features are remnants from mining and ranching activities that occurred in eras prior to the establishment of the range in 1941. The abandoned wells are typically located on deep alluvial desert plains. The remnants of some of these wells remain as unstable, partially collapsed, vertical shafts. Many of the mines have deep shafts in unstable conditions and some have already collapsed. Many of the abandoned mines are located in areas accessible to the public. 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, caves 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.

There are several venomous reptiles and arthropods (including insects and spiders) on the BMGR. Rattlesnakes, scorpions, spiders, and bees are the most likely venomous wildlife hazards on the BMGR.

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. There are no available comprehensive, accurate maps of public use roads on the BMGR, with the exception of the Cabeza Prieta NWR. There are few road signs and no other developed navigational aids on the range to assist those who are unfamiliar with the area. The Air Force, Marine Corps, and BLM are in the process of making an inventory of all current military and public use roads on the BMGR. When this is completed, BLM will produce a transportation plan to designate public use roads and reclaim redundant roads. Driving on the BMGR is most hazardous after rain, when muddy conditions make many roads unpassable, 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.

International Border Issues

The southern boundary of the BMGR shares approximately 94 miles of the international border between the United States and Mexico. Crossing the border in either direction on the BMGR is prohibited by U.S. and Mexican federal law. The Border Patrol is responsible for preventing undocumented aliens from entering the United States and apprehending aliens who have already entered the United States illegally. On the BMGR, the Border Patrol conducts near-daily reconnaissance by air or ground surveillance. In 1996, the Border Patrol reported about 9,500 apprehensions of those illegally entering the United States through the BMGR (Daniels 1997; Moore 1997). The number of apprehensions has been increasing.

Search and Rescue Services

There are no search and rescue services specifically assigned to the BMGR, although MCAS Yuma maintains a helicopter capability for regional search and rescue operations. Range access and entry procedures requiring persons to report on and off of the BMGR are designed to alert the Air Force, Marine Corps, and Cabeza Prieta NWR to possible search and rescue situations. If search and rescue services 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, National Park Service, BLM law enforcement rangers, Yuma County Search and Rescue Team, and/or local sheriff's departments.

3.8 CULTURAL RESOURCES

Cultural resources typically are defined to include archaeological sites, buildings, structures, districts, and objects as those property types have been defined in the National Historic Preservation Act (NHPA), as amended. The NHPA and its implementing regulations provide guidance for determining whether cultural resources are of sufficient importance to be determined eligible for listing on the National Register of Historic Places (National Register). Cultural resources can be either prehistoric or historic in age. In the Southwest, the break between prehistory and history is understood to have occurred in the sixteenth century when written records were produced by Spanish explorers; however, it is recognized that Native American oral traditions also may provide accounts of earlier time periods. To be regarded as historic, properties ordinarily must be at least 50 years old, but younger properties of exceptional importance also are included among cultural resources deemed worthy of consideration under the NHPA.

Traditional cultural places or properties (TCPs) and sacred sites also are included among cultural resources. TCPs (which are addressed in the amended NHPA) are places of special heritage value to contemporary communities (often, but not necessarily, Native American groups) because of their association with the cultural practices or beliefs that are rooted in the histories of those communities and are important in maintaining the cultural identity of the communities. *National Register Bulletin 38* provides guidelines for evaluating whether TCPs may be eligible for National Register listing. TCPs include sacred sites, but also may include other traditional use areas. Sacred sites are defined in Executive Order 13007 as discrete locations identified as sacred by virtue of their religious significance or ceremonial use by Indian religious practitioners.

3.8.1 Inventory Methods

An overview of known cultural resources on the BMGR, compiled and reported in draft by Ahlstrom (1997), was used as the primary source from which to abstract the results described below. Additional documentary materials, preliminary reports, and personal communications concerning ongoing studies were used to supplement the overview, as necessary, and are cited where appropriate.

Research reported by Ahlstrom (1997) was conducted at the following institutions to compile information about archaeological surveys and archaeological sites on the BMGR: Arizona State Museum (ASM), BLM Phoenix and Yuma field offices, Arizona State Historic Preservation Office, Luke AFB, and MCAS Yuma. Approximately 95 percent of the archaeological survey and site information was recovered from the ASM site files. Some inventory data concerning buildings and structures (especially those at ranching and mining locales that have been recorded as archaeological sites) were obtained during the records search. Additional information on buildings and structures that pertain to use of the BMGR during World War II and the Cold War is reported by Bruder and others (1996), Keane and others (1995, 1997), and Rogge and others (1995) as well as being included in the Real Property listing maintained by Luke AFB. An

ethnological study designed to inventory those TCPs and sacred sites that Native Americans (or other traditional communities) may wish to identify is currently underway, as is a study to collect oral histories regarding specific archaeological sites and historic buildings and structures on the BMGR.

The majority of archaeological surveys conducted throughout the BMGR focused on military use areas or areas proposed for military use. A smaller number of surveys have been conducted in advance of various undertakings by the BLM or AGFD, or in BLM special management areas. Most surveys within the Cabeza Prieta NWR, however, has been conducted to address generalized research issues regarding past land use. The same is true of two recent studies sponsored by the Air Force: a survey of the Growler and San Cristobal washes (Slaughter and others 1997), and survey in the vicinity of Tinajas Altas, an important natural water catchment in the western BMGR. These generalized studies also were designed to gather data in areas where threats to cultural resources (from erosion and recreational activities, respectively) were suspected.

3.8.2 Results

Abstracting from the sources cited in the preceding section, an overview of the history of human use and occupation is included here to provide a context for understanding and evaluating the importance of the cultural resources on the BMGR. Thereafter, a summary of known cultural resources is presented.

Cultural History

The cultural history of southwestern Arizona can be divided into seven periods: Paleoindian (ca 10,000-8,000 BC), Archaic (ca 8,000 BC - AD 200), Ceramic (ca AD 200 - 1500), Early Historical (AD 1540 - 1848), Late Historical (AD 1848 - 1941), World War II (AD 1941 - 1945), and Cold War (AD 1946 - 1989). Each is discussed briefly.

Archaeologists consider much, if not all, of the BMGR to lie within a cultural area termed the "Western Papageria." Since Spanish times, southwestern Arizona and northern Sonora, Mexico have been known as the Papageria (Haury 1975:3). The term Papageria is derived from the O'odham word for tepary bean, which the Spanish condensed to Papago (Nabham 1993:113). The Papageria was the traditional territory of the Hia C-ed O'odham (formerly Sand Papago) and Tohono O'odham (formerly Papago Indians). Western Papageria refers to the general physiographic region bounded by the Colorado River to the west, the Gila River to the north, the western portion of the Papago Indian Reservation (home to the Tohono O'odham Nation today) to the east, and Puerto Penasco, Sonora to the south. It was formerly inhabited by the Hia C-ed O'odham, although other cultural groups such as the Quechan, Cocopah, Yavapai, Apache, Maricopa, and the Tohono O'odham are known to have used portions of the region as well.

Paleoindian Period

Archaeologists distinguish between two somewhat distinct cultural traditions in evidence prior to the Ceramic period. The Paleoindian period is generally understood to have preceded the Archaic Period. Reliance on wild plants and animals and mobile settlement systems were characteristic during the entire Preceramic period. The Paleoindian period subsumes the Malpais (considered by some archaeologists to be a pre-Paleoindian manifestation), San Dieguito, and Clovis archaeological complexes. Each is characterized by a distinctive tool kit, and at least the Clovis complex is distinguished by its association with the hunting of now extinct big game species including mammoths. The Late Pleistocene climate during the Paleoindian Period was wetter and cooler than the present, with wooded parklands of piñon and juniper and grasslands, which supported these animals, more widespread.

Archaic Period

During the Archaic period, the climate became warmer and drier and Sonoran Desert conditions were established. The Archaic period in southwestern Arizona has been discussed in terms of two archaeological complexes (Amargosa and Cochise) as well as chronological subdivision into Early, Middle and Late proposed by Huckell (1984). Until the very end of the period, Archaic subsistence is understood to have been based on the collecting of a broad spectrum of wild plant and animal foods, with a concomitant mobile settlement system. 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 adaptive strategies also occurred in the Western Papaguera.

Ceramic Period

Two principal cultural traditions, termed Hohokam and Patayan, are in evidence in the Western Papaguera during the Ceramic period. A third, Trincheras, may be represented as well. As with the Archaic period, various environmental shifts (relating primarily to increased or decreased precipitation) are believed to have occurred and influenced human adaptive strategies, but details are under debate. The Papaguerian regional variant of the Hohokam tradition is recognized principally on the basis of ceramic styles that mirror better known changes through time in ceramic manufacture in the Gila-Salt and Tucson basins. The question of what subsistence-settlement system or systems were adopted by Hohokam occupants of the Western Papaguera is of considerable interest, but the lack of excavation data has thus far hampered the development of definitive answers. Suggestions include (1) sporadic forays to procure specific resources or to access travel corridors; (2) use of the region as a "secondary resource zone," that is, an area visited regularly by groups with permanent residences in better watered areas such as along the Gila River; and (3) the practice of agriculture (possibly a form that relies on the manipulation of runoff on the fans that form at the mouths of arroyos) along with wild resource procurement. The third possibility 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 Papageria as permanent residents, at least during a portion of the prehistoric sequence.

The Patayan cultural tradition is very poorly understood, even along the Lower Colorado River where it has its most obvious expression. The Patayan sequence, which extends into the historic period when it pertains to Yuman speakers, is divided into three phases, recognized principally on the basis of changes in the Lower Colorado Buffware ceramics that characterize the tradition. Lower Colorado Buffwares are found throughout the Western Papageria, being somewhat less common as one moves east where Hohokam ceramics predominate. It has not been determined whether the presence of Lower Colorado Buffwares also implies the presence of Patayan groups in the Western Papageria or whether it reflects contact and exchange between groups on the Lower Colorado and groups that used or occupied the Western Papageria.

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 ceramics are reported from sites within the Western Papageria, and it is possible Trincheras groups actually used the region or were, at least, 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 Spaniards.

Early Historical Period

Evidence for use of the Western Papageria during the Early Historical period is derived almost exclusively from ethnographic studies conducted during the late nineteenth and early twentieth centuries as well as the accounts produced during the earlier Spanish *entrada*. Spanish conquistadors entered the area first, followed by missionaries and later miners and ranchers. The Western Papageria was used principally as a travel corridor by the Spaniards who followed two primary routes: El Camino del Diablo, which runs between Caborca and Yuma, and a north-south route that connected settlements in Mexico with the Gila Bend area.

The presence of Tohono O'odham and Hia C-ed O'odham people in the Western Papageria was reported by the Spanish missionary Father Eusebio Kino who traveled through the area in the late 1600s. Today O'odham groups claim affinity with the prehistoric Hohokam, but some researchers have proposed that they also may have Patayan ties, while other researchers suggest that the O'odham are late (after AD 1450) emigrants to southern Arizona from northern Mexico. 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 and possibly in the Gila-Salt basin. The Zuni have similar histories of migrations that may include the Gila-Salt Basin.

Yuman speakers including the Cocopah, Quechan, Halchidoma, Cohuana, Halyikwamai, Yavapai, Kaveltcadom, and Maricopa occupied various areas along the Lower Colorado and Gila rivers and areas to the north of the Gila River during the Early Historic Period. Frequent resettlement along the rivers was occasioned by warfare among these groups, many of whom

practiced floodwater farming. Yuman speakers are the presumed makers of the Lower Colorado Buffware ceramics produced during the last phase in the Patayan sequence, but the extent of their use of the interior deserts of the Western Papageria is undetermined. The Yavapai, who ranged through a vast territory north of the Gila River, are understood to have relied primarily on hunting and gathering and thus to have practiced a more mobile lifestyle than the riverine dwellers. It is probable the Yavapai ventured south of the Gila at times and thus into the Western Papageria.

Apachean individuals and groups are also known to have made brief forays into the Western Papageria, primarily to engage in raiding and other warfare practices. It is presently unclear as to when these Athapaskan speakers entered southern Arizona, but documentary texts indicate their presence by at least the late seventeenth century.

Late Historical Period

During the Late Historical period, there was increased contact between Native Americans and Euroamericans in the Western Papageria and surrounding areas. During the 1850s a large portion of Hia C-ed and Tohono O'odham territory became a part of the United States with the negotiation of the Gadsden Purchase. In 1846, American troops traveled along the Gila River to fight in California and three years later adventurers referred to as the 49ers bound for the California gold fields followed. El Camino del Diablo served as an alternate route for the 49ers, resulting in many deaths because of the scarcity of water along this southern passage. Various subsequent scientific, data-gathering, or simply travel-related expeditions followed El Camino del Diablo thereafter until the 1940s. By the Late Historical period, just the Cocopah and Quechan remained in residence along the Lower Colorado River, other Yuman speaking groups having migrated east to areas along the Middle Gila River. The extent to which the Cocopah and Quechan used the interior desert east of the Colorado River is not known.

Railroads were constructed within the BMGR during the Late Historical period connecting Gila Bend, Ajo, and Yuma. The initial impetus behind this construction was related to copper mining centered at the New Cornelia Mine near Ajo. Gold also 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. Ranching and homesteading activities took place in the area that was to become the BMGR from the late 1800s to the early 1900s.

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 could be utilized as 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 utilized the range for gunnery training, and during the years of Luke's closure from 1946-1951, Williams personnel managed

the range. In addition, pilots from the Yuma Army Air Base, which was established between 1941 and 1943, trained on the range during World War II. This facility became Vincent AFB in 1956 and in 1959 became 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. Today, Luke AFB operates three live-fire tactical ranges and four live-fire manned ranges within the eastern section of the BMGR. Most ordnance used on these ranges is inert (non-exploding), and all live ordnance is restricted to three select 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.

Known Cultural Resources

To date, studies designed to inventory cultural resources (sites, buildings, structures, objects, districts, and TCPs including sacred sites) throughout the BMGR have been confined to archaeological surveys, with a few notable exceptions. Survey locations are depicted in Figure 3-20. The BMGR encompasses 4,169 square miles of which 1,284 square miles lie within the Cabeza Prieta NWR. The remaining 2,885 square miles of withdrawn public lands are managed by the BLM (including the eastern or Air Force section and the western or Marine Corps section). Within the entire range, approximately 213 square miles (or about 5 percent) have

FIGURE 3-20
CULTURAL RESOURCE INTENSIVE SURVEY LOCATIONS WITHIN THE BMGR
11 x 17 B&W

been surveyed for cultural resources, the majority of effort having been expended in the eastern and western sections of the BMGR (that is, not in the Cabeza Prieta NWR). Most, but not all, of the surveys in the eastern and western sections of the BMGR can be characterized as systematic (within prescribed boundaries) and intensive (that is, walked by archaeological crews spaced at no greater than 20 to 30 meters). Systematic, intensive survey coverage within the eastern and western sections of the BMGR aggregates to 7.8 percent of the total. Just one square mile has been surveyed intensively within the Cabeza Prieta NWR.

Ahlstrom (1997) reports that 440 archaeological sites had been recorded on the BMGR prior to a recent sample survey along Growler Wash and the San Cristobal Valley (Slaughter and others 1997) and another recent sample survey within the East Tactical Range (Roberts and others 1996). The count increases to 605 sites with those two surveys; even more recent surveys in the South, East, and North tactical ranges and in the vicinity of Tinajas Altas on the western side of the BMGR bring the count up to 956 sites (to date, just 605 have been entered in the BMGR database). This equates to roughly 4.4 sites per square mile, suggesting that the entire BMGR may contain as many as 20,000 archaeological sites (although this estimate may be high because at least some of the archaeological studies have concentrated on areas expected to contain high site densities). Because many sites exhibit multiple temporal or functional components, the following discussion, which is based on Ahlstrom's (1997) initial 440-site synthesis, refers to site "components" rather than individual sites. Among the recorded site components, the majority (45 percent) pertain to the (Native American) Ceramic period. Next in abundance are (Euroamerican) Historic period components (22 percent) and prehistoric components of undetermined date (16 percent). No Paleoindian period Clovis site components are recorded, but it is known that four Clovis spear points have been collected on the BMGR. Just under 2 percent of the recorded site components are identified as Paleoindian period Malpais or San Dieguito, 4 percent are Archaic; and just over 2 percent are modern (Cold War period) in date. The remainder (9 percent) of site components could not be assigned to a distinctive temporal division.

The recorded sites contain a variety of features. Ahlstrom (1997) identified 24 distinct feature types in his examination of individual site records. Most relate either to Native American or to Euroamerican site components, but a few feature types can occur in either context. Features common to Native American site components include lithic scatters, quarries, artifact scatters (containing ceramics or lithics and ceramics), bedrock grinding stones, thermal features (hearths, roasting pits, the presence of fire-cracked rock), prehistoric middens, clearings in desert pavement, prehistoric aboveground architecture, pit architecture, and pictographs. Euroamerican site components contain historic mining features, historic structures (or buildings), historic roads or bridges, ranching features, historic water features, historic trash features, historic cemetery features, and historic military features. Features that may pertain to either Native American or Euroamerican site components 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.

The condition of recorded archaeological sites on the BMGR was tabulated using information provided on the 605 individual site forms currently entered into the BMGR database. It must be recognized that these data reflect site condition at the time individual sites were recorded, which for many sites was a number of years ago. Of the 605 sites in the database, 394 are reported to

have sustained some damage: 11 are described as having suffered intentional vandalism; 3 have been affected by construction activities; 63 show evidence of off-road vehicular disturbance; and 122 sites are described as disturbed, with the cause listed as "other." In addition, 195 sites are characterized as having suffered impact from erosion. Luke AFB is currently working with the National Park Service to build a database that will enable managers to track and address threats and disturbances (natural processes such as erosion as well as effects from military and recreational activities, and intentional vandalism) to recorded archaeological sites. Impacts to archaeological sites can result from the following actions associated with military training exercises: air-to-ground ordnance delivery within target complexes, target maintenance and EOD cleanup activities, and general maintenance of roads and wash crossings. The Luke AFB database, which is known as ASMIS for Archaeological Site Management Information System, is expected to be complete by the end of 1998. Luke AFB also is working with the State Historic Preservation Office and the tribes to develop a site stewards program for the BMGR (Rankin 1997).

Properties other than sites can occur within archaeological sites, or sometimes are assigned "site" numbers. On the BMGR, these include buildings, structures, and objects that pertain primarily to historic mining and ranching activities. Six auxiliary airfields that were constructed during World War II also have been assigned site numbers and are included in the counts provided above. Four other World War II auxiliary airfields also are present within the BMGR as are a variety of other facilities built between 1941 and 1945. Of these, 15 World War II period buildings and structures contained within the Gila Bend AFAF have been formally recorded and assessed for National Register eligibility (Keane and others 1995).

The 210 Cold War period buildings and structures in existence at the Gila Bend AFAF in 1996 were recorded and assessed briefly in conjunction with preparation of a Cold War history of that facility (Keane and others 1997). The Cold War period Ajo Radar Station, located within the Cabeza Prieta NWR, also has been recorded and assessed (Keane and Bruder 1994). Numerous additional military properties that pertain to the Cold War are present throughout the BMGR. Current Air Force guidance indicates that only those likely to be regarded as being of exceptional national importance need be regarded as cultural resources (and assessed for National Register listing) at this time (U.S. Air Force 1993). Ahlstrom (1997) identified one such facility: an Intercontinental Ballistic Missile (ICBM) test site identified as the ICBM Silo Superhardening Technology (ISST) Program Test site. Another might be the site of the Buried Trench or Multiple Aim Point Validation (MAV) Project, which was constructed in conjunction with evaluation of an alternate ICBM basing mode specific to the MX (also known as the Missile Experiment, Missile-X, and the Peacekeeper). Both are currently being assessed for National Register eligibility (Pearce 1997).

To date, no TCPs or sacred sites have been definitively identified on the BMGR, but ongoing consultation with Native American representatives from a variety of tribes suggests they may be present. During the public scoping process, concerns were expressed by Tohono O'odham and Hia C-ed O'odham people about the spiritual nature of the entire Papagueria and the possibility that military actions were disturbing ceremonial areas and sacred sites. One potential TCP or

sacred site candidate is located in the western section of the BMGR (Masse 1997). Luke AFB has a study, which addresses the entire BMGR, currently under contract to inventory TCPs and sacred sites and afford the tribes an opportunity to provide ethnohistoric information from their own perspective. Twenty-six groups have been contacted and invited to participate if they are interested. These include all 21 federally recognized tribes in Arizona, plus groups in New Mexico and California that have expressed interest (Zuni Pueblo, the Campo Band of Mission Indians, the Chemehuevi, and the Torres Martinez Desert Cahuilla Indians), and the Hia C-ed O'odham Alliance. As of August 1998, only four tribes have indicated they have no interest in the BMGR. These are the Navajo Nation, Pascua Yaqui Tribe, San Juan Southern Paiute, and Tonto Apache Tribe. All other tribal groups have indicated either they may have affinity with past inhabitants or users of the BMGR, or they are still in the process of evaluating the potential for affinity claims.

Ordinarily, determinations of eligibility for National Register listing (made in consultation between federal agencies and the State Historic Preservation Officer) are used as a means to distinguish important cultural resources from those of less importance. Put differently, determinations of eligibility are used to identify properties that possess significance regarding American history, architecture, archaeology, engineering, or culture. They 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)

A single property within the BMGR is listed on the National Register. This is El Camino del Diablo (site AZ X:7:3 [ASM]), a historic travel corridor between Caborca, Sonora, and Yuma. The listed segment on the BMGR runs from Lukeville to Tinajas Altas at the base of the Tinajas Altas Mountains. The portion of the corridor on BLM-administered land (that is, not within the Cabeza Prieta NWR) is considered a non-contributing element, however, due to a loss of integrity. Portions of the trail north of Tinajas Altas are not included in the National Register listing.

Consultations among the several federal agencies with responsibility for management of the BMGR and the Arizona State Historic Preservation Officer have resulted in "consensus" determinations of eligibility for 62 (10 percent) of the 605 recorded archaeological sites

(including World War II airfields) currently entered in the BMGR database. Of these, 33 (53 percent) have been determined not eligible for listing. Those determined eligible (or potentially eligible) for listing include 21 properties identified as eligible under criterion D, 7 under criteria A and D, and 1 under criteria C and D. The 15 World War II and 114 of the Cold War period buildings and structures at the Gila Bend AFAF have been determined not eligible for National Register listing as has the Ajo Radar Station. The remainder of the Cold War properties may require evaluation when they reach 50 years in age. Of the 543 additional known archaeological sites, recommendations regarding National Register eligibility have been made (by the recorders) for 430 (71 percent). Thirty-eight sites are recommended not eligible for listing. Those recommended eligible (or potentially eligible) include 366 properties identified as eligible under criterion D; 5 under criteria A and D; 2 under criteria B and D; 9 under criteria C and D; 1 under criteria A, B, and D; and 9 with criteria not specified.

Consultation histories and recommendations regarding National Register eligibility were not available for 113 (19 percent) recorded archaeological sites.

3.9 SOCIOECONOMIC RESOURCES

3.9.1 Introduction

The region of influence for the socioeconomic environment of the BMGR includes areas in the immediate vicinity of the BMGR, and installations that rely on the BMGR to support a significant component of their training mission. The degree of effect of (1) the BMGR on the installations and (2) the installations on various affected areas (states, counties, Native American Reservations and communities) must be determined in order to fully describe the affected environment. Because these interrelationships cannot be determined independently, socioeconomic models were applied to published data from the installations and the U.S. Census Bureau to determine estimated socioeconomic effects of the BMGR.

3.9.2 Study Area

The geographic extent of the socioeconomic study area was defined by the states, counties, Native American Reservations, communities, and installations affected by one or more of the following:

- | | |
|---------------------|--|
| # BMGR | # Arizona ANG Base at Tucson International Airport |
| # Luke AFB | # MCAS Yuma |
| # Davis Monthan AFB | # WAATS |
| # MCAS Miramar | |

These military installations lie within four counties in Arizona (Maricopa, Pima, Yuma, and Pinal) and one county in California (San Diego). Although it is understood that these facilities and the BMGR itself have wide-ranging effects on the economies of southern Arizona and

California, specific communities were also selected as a focus of this analysis. The assumption applied to the selection of these communities is that they were, on the basis of proximity, particularly affected by the operations supported by the BMGR. The focus was on incorporated communities near the military installations listed above. Although not an incorporated community, Ajo was included because of its proximity to the BMGR and its status as a census designated place. Native American reservations lying between the BMGR and major urban areas were also included.

For the purpose of the socioeconomic analysis, Native American Reservations within the study area are treated as communities even though they are federally recognized as sovereign entities.

Communities associated with the seven primary military installations affected by the BMGR are shown in Table 3-14, by county, with Native American Reservations shown separately. The study area includes 5 counties, 24 communities, and 8 Native American Reservations (Figure 3-21).

The BMGR also supports deployment programs for active duty, reserve, and ANG flying units from areas of the country with inclement winter weather. MCAS Yuma hosts between 50 and 70 unit deployments a year as well as Navy fliers. During a typical winter season, more than 15 organizations from across the country perform operations at the BMGR during Operation Snowbird (see Section 3.3.2). The economic effects from these transient operations spending money at host installations were included in the analysis for MCAS Yuma and Davis-Monthan AFB. However, the analysis of transient operations did not include the dependence of these units on the BMGR, and the geographic extent of the study area was not expanded to include installations with only transient use of the BMGR.

TABLE 3-14		
COMMUNITIES AFFECTED BY THE BMGR RENEWAL		
All listed communities were included in the analysis.		
County (Military Installation)	City/Community	
Maricopa County, AZ Luke AFB BMGR	Avondale Buckeye El Mirage Gila Bend Goodyear Glendale	Litchfield Park Peoria Phoenix Surprise Youngtown
Pima County, AZ Davis-Monthan AFB Arizona ANG Base at Tucson International Airport WAATS BMGR	Ajo Marana	South Tucson Tucson
Yuma County, AZ MCAS Yuma BMGR	San Luis Somerton	Wellton Yuma
Pinal County, AZ WAATS	Casa Grande	
San Diego County, CA MCAS Miramar	El Cajon Poway	San Diego Santee
Native American Reservations Luke AFB Davis-Monthan AFB Arizona ANG Base at Tucson International Airport MCAS Yuma WAATS	Ak Chin Indian Reservation Ft. Yuma-Quechan Indian Reservation Gila River Indian Community Gila Bend Indian Reservation* Pascua Yaqui Tribe San Xavier Indian Reservation* Tohono O'odham - Sells Main Reservation* Cocopah Indian Reservation (East and West)	
*Together these non-contiguous reservations and the 20-acre Florence Village, near Florence, Arizona comprise the Tohono O'odham Nation.		

FIGURE 3-21
SOCIOECONOMIC STUDY AREA
8 ½ X 11 B&W

3.9.3 General Demographic Trends and Economic Conditions

Data such as population; employment by level of participation, sector, and occupation; household income; poverty status; and race were collected for the affected states, counties, Native American Reservations, communities, and installations. The data were compiled and the following demographic and economic conditions and trends were identified.

Population trends and projections. The population for each of the states, counties and communities are depicted in Table 3-15. Only 9 of the 24 incorporated communities in the study area had populations exceeding 20,000 and only four had populations exceeding 100,000. In general, population trends throughout the study area show a strong pattern of historic growth through 1995 (Table 3-16). Population projections indicate that the states, counties, and communities are expected to continue their growth patterns at least through 2020. Where statistics were available on net migration in the study area, net migration was identified as an increasing component to overall growth.

Employment. In Arizona statewide, the total labor force in 1990 was 1,798,000 and the total number of persons older than 16 years who were unemployed was 96,000, resulting in an unemployment rate of 5.3 percent (Table 3-17). In California, the 1990 total labor force was 15,262,900 with 996,502 persons older than 16 unemployed for an unemployment rate of 6.5 percent.

For the counties in the study area, San Diego County had the largest labor force at 1,330,763 and the largest number of persons greater than 16 years of age unemployed at 74,486. The smallest labor force was in Yuma County at 41,951. The smallest number of persons greater than 16 years of age unemployed was Pinal County at 4,075. Yuma County had the highest unemployment rate at 11.4 percent, while Maricopa County was the lowest at 6.0 percent. The average unemployment rate for these counties was 8.0 percent.

For the communities in the study area, San Diego has both the highest number of persons in the labor force at 607,612 and the highest number of persons greater than 16 years of age unemployed at 34,784. Ak-Chin Indian Reservation has the lowest in both categories, at 121 and 14, respectively. The Tohono O'odham Nation has the highest unemployment rate at 56.3 percent, while Peoria has the lowest at 4.7 percent. Peoria is the only community in the Arizona portion of the study area where the unemployment rate is below the state average. In California, Poway, San Diego, and Santee all reported lower unemployment rates than the state average in 1990.

Income Characteristics. As shown in Table 3-18, the 1990 median household income in Arizona was \$27,540 and was \$35,798 in California. The median household income for the Arizona counties included in this survey was slightly lower than the state-wide average, at \$25,284. The median household income for San Diego County (at \$35,022) was similar to the California

TABLE 3-15
1990 POPULATION COMPOSITION:
POVERTY, RACE, AND HISPANIC ORIGIN FOR AFFECTED AREAS

Affected Area	Total Population	Percent of Total Population			
		Below Poverty	White	Native American	Hispanic Origin
ARIZONA					
Maricopa County	2,121,102	12.1	84.9	1.8	16.0
Avondale	16,169	27.8	58.6	1.4	51.3
Buckeye	5,038	24.6	75.4	3.0	27.6
El Mirage	5,001	32.5	35.3	.7	79.0
Gila Bend	1,747	31.3	71.1	8.2	42.2
Glendale	148,134	11.3	85.2	1.0	15.0
Goodyear	6,258	9.3	71.5	2.6	24.8
Litchfield Park	3,303	3.7	98.0	.2	2.6
Peoria	50,618	7.7	87.6	.5	15.2
Phoenix	983,403	14.0	81.7	1.9	19.7
Surprise	7,122	27.4	54.7	.4	57.5
Youngtown	2,542	13.4	94.9	.2	6.3
Pima County	666,880	16.8	78.9	3.0	24.2
Ajo	2,919	23.2	85.4	10.0	43.1
Marana	2,187	17.7	71.1	6.0	30.5
South Tucson	5,093	50.5	28.9	10.0	81.5
Tucson	405,390	19.6	75.4	1.6	28.9
Yuma County	106,895	19.2	75.7	1.5	41.8
San Luis	4,718	34.9	97.0	0	99.6
Somerton	5,282	43.9	80.4	.8	95.5
Wellton	1,066	21.9	63.9	2.3	43.4
Yuma	54,923	15.7	73.7	1.2	35.3
Pinal County	116,379	22.5	74.9	9.6	n/a
Casa Grande	19,028	17.2	76.8	2.6	n/a
<i>Native American Reservations</i>					
Ak-Chin	369	46.6	0	95.7	n/a
Cocopah (East and West)	1,718	41.8	70.8	25.2	50.7
Ft. Yuma-Quechan	3,155	36.2	42.4	38.5	18.4
Gila Bend	n/a	n/a	n/a	n/a	n/a
Gila River	9,578	62.0	2.1	95.0	11.6
Pascua Yaqui	n/a	n/a	n/a	n/a	n/a
Tohono O'odham	8,422	64.5	0.9	98.8	4.1
San Xavier	1,129	64.6	1.6	96.3	3.5
CALIFORNIA	29,760,021	12.2	70.0	0.8	25.8
San Diego County	2,498,016	10.9	74.9	0.8	20.4
El Cajon	88,693	12.6	87.4	1.0	14.0
Poway	43,516	4.0	89.9	0.5	6.9
San Diego	1,110,549	12.8	67.1	0.6	20.7
Santee	52,902	5.2	91.1	0.8	10.7

Source: 1990 U.S. Census data in U.S. DoD, Luke AFB 1996. n/a = not available

Note: Race statistics presented in this table will not add to 100 percent for two reasons: (1) statistics on African Americans and Asian and Pacific Islanders are not presented in the table, and (2) Hispanic origin statistics represent ethnicity (not race) and include all persons who identify themselves as of Hispanic origin or decent.

TABLE 3-16
POPULATION HISTORIES AND PROJECTIONS FOR COUNTIES AND
COMMUNITIES IN SOCIOECONOMIC STUDY AREA
11 x 8 ½ B&W

**TABLE 3-17
LABOR FORCE AND UNEMPLOYMENT FOR COMMUNITIES
IN STUDY AREA, 1990**

Affected Area	Total Civilian Labor Force	Unemployed Persons (older than 16 years)	Unemployment Rate
ARIZONA	1,798,000	96,000	5.3
Maricopa County	1,070,667	64,742	6.0
Avondale	6,556	745	11.4
Buckeye	2,160	295	13.7
El Mirage	2,065	147	7.1
Gila Bend	739	80	10.8
Glendale	78,370	4,760	6.1
Goodyear	2,022	152	7.5
Litchfield Park	1,525	83	5.4
Peoria	22,884	1,075	4.7
Phoenix	515,284	34,339	1.7
Surprise	2,547	248	9.7
Youngtown	649	44	6.8
Pima County	313,831	23,773	7.6
Ajo	756	82	10.8
Marana	985	55	5.6
South Tucson	1,771	323	18.2
Tucson	196,051	16,349	8.3
Yuma County	41,951	4,762	11.4
San Luis	1,706	750	44.0
Somerton	1,625	391	24.1
Wellton	382	42	11.0
Yuma	23,447	1,763	7.5
Pinal County	44,401	4,075	9.2
Casa Grande	8,868	701	7.9
Native American Reservations			
Ak-Chin	121	14	11.6
Cocopah (East and West)	617	69	11.2
Ft. Yuma-Quechan	937	150	16.0
Gila Bend	n/a	n/a	n/a
Gila River	2,788	826	29.6
Pascua Yaqui	601	142	23.6
Tohono O'odham	551	310	56.3
San Xavier	381	63	16.5
CALIFORNIA	15,262,900	996,502	6.5
San Diego County	1,330,763	74,486	5.6
El Cajon	44,872	3,171	7.1
Poway	23,634	907	3.8
San Diego	607,612	34,784	5.7
Santee	28,306	1,426	5.0
n/a = not available			
Source: U.S. DoD, Luke AFB 1996; U.S. Census 1990			

TABLE 3-18 INCOME CHARACTERISTICS 1990	
Affected Area	Median Household Income (\$)
ARIZONA	27,540
Maricopa County	30,797
Avondale	24,292
Buckeye	24,896
El Mirage	20,372
Gila Bend	17,820
Glendale	31,665
Goodyear	32,708
Litchfield Park	57,563
Peoria	34,205
Phoenix	29,291
Surprise	21,750
Youngtown	15,819
Pima County	25,401
Ajo	16,302
Marana	22,245
South Tucson	9,869
Tucson	21,748
Yuma County	23,635
San Luis	15,554
Somerton	15,094
Wellton	16,574
Yuma	26,753
Pinal County	21,301
Casa Grande	25,926
Native American Reservations	n/a
Ak-Chin	15,341
Ft. Yuma-Quechan	11,466
Gila Bend	n/a
Gila River	10,418
Pasqua Yaqui	n/a
Tohono O'odham Nation	9,527
San Xavier	7,361
Cocopah Tribe	15,710
CALIFORNIA	35,798
San Diego County	35,022
El Cajon	28,108
Poway	53,252
San Diego	33,686
Santee	39,073
Average median household income for affected counties in Arizona	\$25,284
Average median household income for affected communities in Arizona	\$21,164
Average median household income for affected California communities	\$38,530

TABLE 3-18 INCOME CHARACTERISTICS 1990	
Affected Area	Median Household Income (\$)
Overall average median income for affected counties	\$27,231
Overall average median income for affected communities	\$23,480
n/a = not available Source: U.S. DoD, Luke AFB 1996	

statewide average. The county with the highest median household income was San Diego at \$35,022; the lowest was Pinal at \$21,301. The median household income for the Arizona communities included in this survey, at \$21,164 was considerably lower than the Arizona state average. The median household income for the California communities included in the study, at \$38,530, was higher than the California state average. The overall average median household income was \$27,231 for the affected counties and \$23,480 for the affected communities. The community with the highest median household income was Litchfield Park at \$57,563; the lowest was San Xavier Indian Reservation at \$7,361.

Poverty status. Areas having incidences of poverty near or more than 50 percent include the community of South Tucson and nearly all of the Native American Reservations analyzed (see Table 3-15). The San Xavier Reservation and the Tohono O’odham Reservation display the highest levels of poverty at 64.6 and 64.5 percent of the population, respectively.

Race and Hispanic Origin Ethnicity. As shown in Table 3-15, the areas displaying the highest concentration of minorities are Native American Reservations areas where the percent population of Native Americans is as high as 98.8 percent. Apart from the reservations, Native American populations do not exceed 10 percent of the population in any of the affected communities. Hispanic origin statistics represent all persons who identify themselves as Mexican, Puerto Rican, Cuban, Central American, or of other Hispanic origin or decent. These data reflect ethnicity, not race. The Hispanic-origin ethnic group exceeds 50 percent of the population in the Avondale, El Mirage, San Luis, Somerton, South Tucson, and Surprise communities, as well as the Cocopah Reservation.

The White American portion of the population in the communities within the study area varied greatly from 98 percent in Litchfield Park to zero in the Ak Chin Reservation.

Neither African Americans nor Asian nor Pacific Islanders are strongly represented in any part of the study area. San Diego displays the highest percentage of African Americans (8.9 percent) and Asian/Pacific Islanders (11.1 percent) in the study area.

3.9.4 Economic Profiles

The economy of southern Arizona is based primarily on trade, government, service, agriculture, manufacturing, construction, and mining. With the exceptions of Glendale, Tucson, Yuma and Peoria, the affected communities are communities with populations of less than 20,000.

Southern Arizona's climate attracts retirement and "winter visitor" populations that feed the retail trade and tourism industries. Avondale, Gila River Indian Community, Tohono O'odham Nation, Litchfield Park, Phoenix, Surprise, Youngtown, Ajo, South Tucson, Tucson, Cocopah Tribe, Pasqua Yaqui Tribe, Buckeye, Gila River Indian Community, Glendale, Goodyear, Peoria, San Luis, Casa Grande, and Ft. Yuma-Quechan Tribe all reap economic benefits from either entertainment and recreation services, tourism, or other related services for this population (Arizona Department of Commerce 1996). The Cabeza Prieta NWR is a tourist destination within the BMGR. Kofa NWR and Organ Pipe Cactus National Monument are among the tourist destinations in the vicinity of the BMGR.

Agriculture is an important economic activity to many of the affected communities such as El Mirage, Gila Bend, Gila River Indian Community, Buckeye, Surprise, Marana, Tohono O'odham Nation, San Luis, Cocopah Tribe, Ft. Yuma-Quechan Tribe, Somerton, Wellton, Yuma, Ak-Chin Indian Community, and Casa Grande.

In the past, mining activities provided a primary economic resource to Ajo, Marana, Tucson and Casa Grande. Recently, economic dependency on mining has lessened and these communities have seen an increase in manufacturing and trade activities. However, the open pit copper mine near Ajo may be reopened within the next several years.

Military contributions to community economies are most pronounced in Avondale, Glendale, Marana, Tucson, and Yuma. Luke AFB primarily affects Avondale and Glendale, WAATS primarily affects Marana, Davis-Monthan AFB and Tucson ANG primarily affect Tucson, and MCAS Yuma primarily affects the Yuma vicinity.

Construction; manufacturing; other services; and federal, state, and local government provide the balance of economic activity for the affected communities in Arizona.

In San Diego County, the three leading industries are manufacturing, defense, and tourism. Nearly 20 percent of the county's gross regional product can be attributed to manufacturing with leading industries being aerospace, transportation, and shipbuilding; industrial machinery and computers; electronics; and instruments. With one-half of the U.S. Navy's Pacific Fleet home ported in San Diego, the defense industry makes a substantial contribution to the economy. The third largest industry is tourism (San Diego Regional Economic Development Corporation 1998).

3.9.5 Allocation of Existing Economic Effects

Direct and Indirect Employment from Installations

Direct employment data include the number of full- and part-time personnel assigned to the installation and their payrolls. Published material on economic effects prepared at the affected military installations and interviews provided the necessary data to establish direct employment

figures. Gross payrolls at the military installations utilizing the BMGR total \$590 million. Indirect employment data is generated, in part, from direct employment data and represents the jobs that are generated by installation expenditures on items such as supplies, services, transportation, and contracts. Gross installation expenditures total \$2.8 billion (U.S. DoD, Luke AFB 1998).

Because data provided by the installations varied significantly in the level of detail, data were standardized into eight general expenditure categories:

- # contracts and direct spending, maintenance and operations
- # contracts for construction and building maintenance/repair
- # spending for supplies
- # payments to retirees
- # spending by temporary or visiting personnel, trainees, etc.
- # utilities
- # salaries to contractors
- # commissary, base exchange, and health services

An interaction model referred to as the gravity model⁴² was used to theorize a relationship between the communities and the military installations that use the BMGR. The theoretical relationship between the installation and the affected economic sectors was further defined by relating the eight categories of installation reported expenditures to community employment in corresponding industries (U.S. DoD, Luke AFB 1996).

Contribution of the Installation to the Community

The interaction values generated by the gravity model were then translated to values that could be used to determine the theoretical effect of each installation on each county and community. The Regional Industrial Multiplier System⁴³ was used to determine the values for indirect employment and earnings by county. The model includes considerations for how much of each installation's mission is currently supported by the BMGR.

Tax Revenues

To determine the effects of employment and earnings on tax revenues to the state, counties, and affected communities, a sub-model was created within the interaction model. The sub-model was used to calculate the effects of sales tax, property tax, and revenue sharing on the state, counties,

⁴² The gravity model is based on the principle of physics that the attraction of two masses for each other is directly related to the size of each and inversely related to the distance between them. For the purposes of this study, the mass of the installations remained constant while the mass on the communities varied. The mass of the communities was derived from community employment figures.

⁴³ The Regional Industrial Multiplier System is a model that is widely used by both the public and private sectors to estimate regional economic impacts.

and communities. Taxable sales were reduced to reflect on-base spending by military personnel and retirees.

The results of the model show only the BMGR component of effects related to the military installations, not the total effects from all activities at those installations. In the study area it is estimated that a total of 17,171 direct jobs and 49,231 indirect jobs are supported by the BMGR. The estimated total wages from these jobs is \$1.8 billion. For the counties analyzed, an estimated 37,749 employed persons and about \$1 billion in annual earnings are related to operations at the BMGR (Table 3-19). For the communities analyzed, an additional 28,575 persons are employed, resulting in about \$764 million in annual earnings in these communities. An additional \$19.5 million in total tax revenues is generated for the affected communities. Effects at the community level range from 5,953 jobs, about \$163.5 million in earnings, and \$5.9 million in tax revenue for Phoenix to negligible amounts of employment and revenues to some of the Native American Reservations (U.S. DoD, Luke AFB 1998).

TABLE 3-19 AGGREGATION OF SOCIOECONOMIC MODELING RESULTS FOR ALL STATES, COUNTIES, AND COMMUNITIES ANALYZED IN STUDY AREA			
	States	Counties	Communities
Number of worker household 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		\$4,733,447	\$5,919,479
Property Taxes		\$6,144,920	\$10,180,773
Revenue Sharing			\$3,428,438
Total Tax Revenues		\$10,878,367	\$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.			

3.10 VISUAL RESOURCES

3.10.1 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 57 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 potentially modify natural landscapes. Military modifications to the landscape include roads, vehicle tracks from

off-road vehicle 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.

Aside from incidental viewing of the range (secondary to watching the road) 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 3.11, the BMGR is accessible for public recreation use subject to the constraints of the overriding military training mission for which the range was established.

As the land manager for the non-Cabeza Prieta NWR portion of the BMGR, the DOI through the BLM is responsible for the management of visual resources on the non-Cabeza Prieta NWR portion of the BMGR under the provisions of the Lower Gila South RMP Goldwater Amendment. The USFWS is responsible for the management of the Cabeza Prieta NWR visual resources.

3.10.2 Study Area

The visual resource study area includes the 1,842,423-acre eastern and western sections 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. Military features within the refuge are limited to five remotely located communication sites, four of which are not readily within the viewing range of the public. The fifth site is located on Childs Mountain. A viewpoint at Childs Mountain was selected for inclusion in this study primarily because of a proposed watchable wildlife overlook, which includes views of aircraft and military facilities associated with BMGR training activities (USFWS 1997).

3.10.3 Data Collection Methods

To describe the existing visual resources of the BMGR, existing data combined with field surveys were used to inventory existing visual conditions. The current BLM 8400 series Visual Resource Management (VRM) manual served as the basis to develop a consistent methodology for the visual resource inventory.

The primary existing data sources used for this study included 1:100,000 scale U.S. Geological Survey topographic maps, 1:80,000 scale national high altitude 1986 aerial photograph series, and U.S. Space Command 1991 satellite imagery of the BMGR and surrounding area. In addition, the interim BLM VRM classes established in the 1990 Lower Gila South RMP Goldwater Amendment were studied and mapped.

3.10.4 Visual Resource Management Objectives for the BMGR

Interim Visual Resource Management Classifications

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 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 (Table 3-20).

TABLE 3-20	
BLM VISUAL RESOURCE MANAGEMENT CLASSES	
Class I	This class provides primarily for natural ecological changes; however, it does not preclude very limited activity. Any contrast created within the characteristic environment must not attract attention. Wilderness areas are mandated as Class I.
Class II	Changes in any of the basic elements (form, line, color, texture) caused by a management activity should not be evident in the characteristic landscape. A contrast may be seen but should not attract attention. Wilderness study areas receive an interim Class II designation.
Class III	Contrasts to the basic elements (form, line, color, texture) caused by a management activity may be evident and begin to attract attention in the characteristic landscape. However, the changes should remain subordinate to the existing characteristic landscape.
Class IV	Contrasts may attract attention and be a dominant feature of the landscape in terms of scale; however, the change should repeat the basic elements (form, line, color, texture) inherent in the characteristic landscape. (BLM 1986).

In the 1990 Lower Gila South RMP Goldwater Amendment, the BLM established interim BMGR visual resource management classes for the following described areas until such time when visual resource management plans and mapping could be completed:

- # *Class II*: ACECs, other management areas such as SRMAs and HMAs, mountain ranges, and recreation travel corridors
- # *Class IV*: San Cristobal Valley (due to intrusions from DARTs), the target range areas of the eastern section of the range, the ISST site, and Baker Peaks ground support complex

All other areas of the range not specifically addressed by the RMP were designated as Class III for management of visual resources. In consultation with BLM, these interim resource management classifications were mapped as a component of this study (Figure 3-22).

Some portions of the Sentinel Plain SRMA Class II area overlap with the Class IV North TAC and Range 4 areas (see Figure 3-22).

Other Management Actions

Visual resource management actions contained in the RMP include:

- # protecting mountain vistas from visual intrusion by developing, during site or project specific activity planning, visual resource management prescriptions needed to maintain appropriate visual resource management objectives
- # protecting the visual resource quality on land adjacent to El Camino del Diablo, Interstate 8, and State Route 85
- # lessening, preventing, or mitigating further degradation of visual and scenic resources on the BMGR by assisting the Air Force and the Marine Corps on future siting of military surface use areas
- # if requested by the Air Force or Marine Corps, assisting in the development of plans for removal of errant DARTs in order to minimize or avoid impacts to natural and cultural resources

3.10.5 Study Methods

Scenic Quality

The inventory of BMGR scenic quality included evaluation of landform, vegetation, water, color, influence of adjacent scenery, scarcity of features, and cultural modifications. Areas consisting of similar physiographic and visual characteristics were classified as either Class A, Class B, or Class C landscapes (Table 3-21). Landscapes with a greater diversity of features typically have a greater aesthetic appeal and, therefore, high scenic quality.

TABLE 3-21 BLM 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, and 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.

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 proposed for designation as a backcountry byway, 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 ACEC, Mohawk Mountains and Sand Dunes ACEC, and Air Force Management Areas A and B
- # *Other Popular Recreation Areas*—the Baker Tanks Pavilion Area, Fortuna Mine, and unauthorized off-road vehicle use 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

FIGURE 3-22
BLM INTERIM VISUAL RESOURCE MANAGEMENT CLASSIFICATION
FOR THE EASTERN AND WESTERN SECTIONS OF BMGR
11 X 17 B&W

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.

3.10.6 BMGR Visual Resource Inventory Results

This section documents the results of the visual inventory for each of the study components including scenic quality, viewpoints, and visual sensitivity.

Scenic Quality

Of the 1,842,423 acres included in the analysis, 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 (Figure 3-23). In the eastern and western land sections of the range, 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 following mountain ranges: Sand Tank, Saucedda, Crater Range, Growler, Aguila, Granite, Mohawk, Copper, Tinajas Altas, and the Gilas; the Sand Tank Mountain basins; Mohawk Sand Dunes; and the San Cristobal Wash.

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 desert scrub vegetation. These landscapes included the valley area southeast of Gila Bend between the Saucedo Mountains and Sand Tank Mountains, Childs Valley, San Cristobal Valley, and Mohawk Valley.

3.10.7 Viewpoints, Visibility, and Visual Sensitivity

Visibility and Visual Sensitivity

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. It should be noted that 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 along 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 made aware of the military context of the range. Therefore, military modifications are often expected and, for some, add interest to the area.

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 are screened (restricted and internalized) 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. Aircraft and dirt plumes introduce temporary and transient visual impacts. At times, military aircraft operations are also visible from the highway, particularly low-level flight in preparation for strafing and bombing manned range targets and night operations involving flares that light the

FIGURE 3-23
SCENIC QUALITY CLASSIFICATIONS FOR THE EASTERN
AND WESTERN SECTION OF THE BMGR
11 x 17 B&W

night sky. The cloud of dust that results from a large net explosive weight HE munitions delivery to East TAC HE Hill can also be seen from State Route 85. Non-military modifications along this highway include a 69kV transmission line; the Tucson, Cornelia and Gila Bend Railroad; the BMGR perimeter barbed wire fence; and roadside stops with shelters and trash receptacles.

With the exception of rest areas near Sentinel and Dateland, which are high sensitivity views, 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 there is screening due to terrain. 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 Multiple Aim-point Validation (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, barbed wire 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 the El Camino del Diablo east of the TACTS range main airfield/ISST 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 3-8, include the following:

- # *Air Force Management Area A and Area B*—views of these areas range from foreground to background. Views of Sonoran Desert upland landscapes are undisturbed, except for recreation travel routes and historic mining and well sites that add visual interest.
- # *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. There has also been some graffiti painted on or carved into some of the rock faces.
- # *Sentinel Plains 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 to most of this area is limited to the few times when no military operations are scheduled; public access is not allowed within North TAC and manned Range 4.

- # *Mohawk Mountains and Sand Dunes ACEC*—foreground and occasional middleground views from two-track roads within this ACEC are high sensitivity. 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 ACEC*—foreground views are primarily concentrated along the 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 proposed 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 non-Cabeza Prieta NWR portion of the range 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.

Military Use Areas

Military use areas within the BMGR have variable viewing conditions associated with use. These views were primarily in the foreground and were considered low sensitivity viewpoints 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, 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 edges 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 were considered high sensitivity views and have variable viewing conditions. Views from residences on the southern edge of Gila Bend toward 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 include facilities located along the top of Childs Mountain. These residential views 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.

3.11 RECREATION

3.11.1 Introduction

The land withdrawal and restricted airspace associated with the BMGR has resulted in the conservation of one of the largest and best preserved remaining tracts of native Sonoran Desert.

The vast majority of the range functions as a necessary land and airspace safety buffer for training with aircraft weapons and is relatively undisturbed, while the land area required for bombing and gunnery targets and other training support functions is small in contrast to the total range area. The relatively undisturbed nature of the BMGR has also benefited from its remote location away from major population centers and the lack of any substantial surface water attractions within or near its borders. These factors have historically served to keep outdoor recreation activities within the range at low levels.

The BMGR does, however, possess spectacular scenery, historic and prehistoric cultural sites, diverse flora and fauna, unique geologic features, and a sense of wildness that suggests a potential for attracting outdoor recreation interests beyond the level of activity currently experienced. The BMGR is accessible for public recreation use subject to the constraints of the overriding military training mission for which the range was established. Recreation use is managed by rules and regulations established to prevent interference with military training missions, protect public health and safety, and reduce federal liability. Such use is also actively managed to protect and preserve the natural and cultural resources of the range.

Opportunities for recreation include hunting, backpacking, hiking, camping, picnicking, photography, auto touring, nature study, some four-wheel drive use, visiting cultural sites, rockhounding, and sightseeing. The suitability of areas within the range for recreation varies, depending on area-specific military training missions. For example, tactical and manned ranges, which include live-fire targets, are necessarily closed to recreation. Other range locations used for air-to-air training with little or no live firing are available for a wider variety of activities and for most of the year.

3.11.2 Study Area

The recreation study project area includes the BMGR and a region of influence determined by alternative recreational opportunities within the vicinity of the range and within the same general travel distance from major population centers including Phoenix, Tucson, and Yuma. The region of influence is generally regarded as that within 20 miles of the BMGR boundary.

3.11.3 Data Collection Methods

Information on the recreational resources within the BMGR study region was collected primarily through an intensive search of existing literature and maps. Telephone interviews were conducted with staff from administering agencies to gather additional information and to verify the accuracy of the secondary data. Data collection efforts did not incorporate surveys on visitor use or attitudes or other types of primary data collection.

3.11.4 Recreation Use and Management Within the BMGR

Land management on the BMGR is a product of the multi-agency administration of the range. This multi-agency administration affects recreation policy and practice on the range. The following description of the existing recreation conditions has been organized to reflect the various policies and procedures for each of the administering agencies. A description of BLM administered recreation resources is provided first, followed by other recreation-related information described by the administering agency.

Bureau of Land Management

As outlined in the 1990 Lower Gila South RMP Goldwater Amendment, the primary BLM recreation management objectives for the BMGR are 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 include 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.

The RMP also contains management prescriptions designed to reduce impact on the management and preservation areas designated with the plan. These prescriptions set limits or restrictions on recreational use in order to protect the natural and cultural resource values for which the areas were designated. Conversely, these restrictions also protect the interests of future recreational users that will be attracted to these same resources. Additional information regarding the location, designation, and resources of these management and preservation areas is provided in Section 3.4 and Figure 3-19.

Restrictions on recreation use of the three designated ACECs (Tinajas Altas Mountains, Gran Desierto Dunes, and Mohawk Mountains and Sand Dunes) includes 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 ranger patrol of the ACEC (U.S. DOI 1990). 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. Public access to the Gran Desierto Dunes ACEC is restricted because of the ACEC's proximity to a live-fire range (see Figure 3-8). A portion of the Mohawk Mountains and Sand Dunes ACEC is also closed to public entry most of the time because it underlies the air-to-air range complex within R-2301E.

The only restriction on recreation use for the two designated SRMAs (Sentinel Plain Lava Flow and Crater Range) is that vehicle use is limited to designated roads. However, since both SRMAs are in locations adjacent to live-fire ranges, public visitation in these areas is very limited or, in some locations, prohibited because of the live-fire hazards (see Figure 3-19).

Restrictions related to recreation use of the Yuma Desert and Sand Dunes HMA limit vehicle use to designated roads only (with no cross-country use or dune travel), establish interpretive facilities, and prohibit woodcutting. As with the SRMAs, public access to the HMA (which is located in the same vicinity as the Gran Desierto Dunes ACEC) is restricted because of its proximity to a live-fire range.

Traveling El Camino del Diablo, including the portions of this backcountry byway located on the BMGR, is a popular activity. Restrictions related to recreation use of El Camino del Diablo Backcountry Byway prohibit all firewood collection within 150 feet of the byway corridor, allow only dead and downed wood to be collected from outside the corridor, and restrict vehicle-based and self-contained camping to within 50 feet of the road.

Many of the management prescriptions listed above have not yet been implemented. Current BLM recreation-related plans for the near-future include installing interpretive information along El Camino del Diablo and installing boundary signs along the Mohawk Mountains and Sand Dunes ACEC. The BLM is currently creating an inventory, classification, and map of public use roads (Henry 1997). Management actions that have occurred on the BMGR since the ROD for the Lower Gila South RMP Goldwater Amendment are the:

- # clean-up and maintenance of the Baker Tanks Pavilion Area
- # installation of a bat-friendly steel gate at the Old Soak and Betty Lee Cistern mines
- # repair of the chain-link fence surrounding the Fortuna Mine
- # correction of wildlife drowning hazards at two natural potholes in the Tinajas Altas Mountains
- # installation of five new wildlife water catchments
- # completion of the Lechuguilla-Mohawk Habitat Management Plan
- # additional wildlife habitat maintenance and enhancement projects on the eastern side of the BMGR
- # participation in the cultural resources inventory at Tinajas Altas, including leading a tour for the Cocopah elders
- # participation in the clean up and rehabilitation efforts after aircraft mishaps
- # installation of information signs at all major road entries into the BMGR
- # installation of boundary signs along County 14th Street, which forms the northern boundary of the BMGR in this area near Yuma

U.S. Fish and Wildlife Service

Like other portions of the BMGR, no one may enter the Cabeza Prieta NWR without obtaining a valid entry permit and signing a military hold harmless agreement. 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 are instructed not to touch ordnance, to note its location, and report it to refuge staff. Vehicles are restricted to approved roads.

Recreational opportunities on the Cabeza Prieta NWR include backpacking, hiking, hunting, camping, mountain biking, wildlife observation, photography, and appreciation of wilderness solitude. Hunting is permitted for bighorn sheep only in accordance with hunting seasons and regulations of the AGFD. El Camino del Diablo attracts the highest level of recreational activity within the refuge. 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 Lechugilla Desert in the western section of the BMGR where the roadway turns northwest towards Wellton and Yuma.

The refuge maintains records on the number of visitors to the refuge on an annual basis. Table 3-22 represents refuge visitation from 1992 to 1996 (Thompson-Olais 1997). Over the last five years the refuge has experienced a continuing increase in visitation with an average change of 32.6 percent annually. All indications are that visitation will continue to increase into the foreseeable future.

TABLE 3-22		
CABEZA PRIETA NATIONAL WILDLIFE REFUGE VISITATION		
Year	Approximate Number of Visitors	Percent Change from Previous Year
1992	669	N/A
1993	1,028	+53.7
1994	1,400	+36.2
1995	1,500	+7.1
1996	2,000	+33.3
Source: Thompson-Olais 1997		

Air Force Recreation Management Areas

The Air Force allows recreation to occur within four designated non-target, non-impact areas known as Areas A, B, C and D in the eastern section of the BMGR (see Figure 3-19). A description of these management areas is provided in Section 3.4.

Any individual requiring or desiring access to any portion of the eastern section of the BMGR for military or non-military purposes must annually receive an EOD Range Safety and Environmental Protection Briefing, and sign an EOD/Range Briefing Statement and Range Entry Form. The Range Safety Briefing is conducted by the ROCC at the Gila Bend AFAF or at Luke AFB.

Prior to FY 1995, access to manned, tactical, and air-to-air ranges for activities such as hunting and sightseeing was allowed upon approval from the ROCC. Beginning in FY 1996, the Air Force discontinued recreation access to these areas, but allowed permitted access to Areas A and B and limited permitted access to Areas C and D. Recreation access has always been prohibited in areas used for military deployment or field training exercises. While recreational access remains prohibited in the manned and tactical ranges, in FY 1998 other areas in the eastern section of the range were reopened to the public when no military operations are scheduled.

The Air Force has established a Range Access Control Log Database for the BMGR. This database contains information on range visitation that is valuable for recreation planning. The database includes the visitor's area of destination, activity categories, date in, date out, number in party, and person-days. The Air Force estimates that anywhere from 50 to 75 percent of non-military use of the range is not formally permitted and therefore is not included in the database (Barry 1996).

The database has a total of 453 recreation-related entries logged in FY 1996. Of these entries, 83 percent are for hunting.

U.S. Marine Corps

The western section of the BMGR, where military operations are scheduled by the Marine Corps, currently provides local day-use and overnight recreation opportunities. An entry permit must be obtained from MCAS Yuma for local recreation. In addition to the use-permit application, a hold harmless agreement must be signed by each member of a party to certify that the visitor is aware of hazards and is responsible for his/her own safety. The boundaries of this portion of the range are marked, but not fenced. The requirement for access permission is clearly indicated through signs and public information programs.

MCAS Yuma statistics regarding visitor use are available for the last two permit years. For July 1995 through June 1996, 599 permits were issued, the total number of visitors was recorded at 3,498, and the number of civilian vehicles entering the range for recreation was 1,836. For July 1996 through June 1997, 848 permits were issued, the total number of visitors was recorded at

3,924, and the number of civilian vehicles entering the range for recreation was 2,080. Permits are valid for one year and can be used for multiple-person parties. An unknown volume of non-permitted use also occurred (U.S. DoD MCAS Yuma 1997).

Primary activities include camping, picnicking, hiking, sightseeing, hunting, visiting cultural sites, auto touring, rockhounding, and observing nature. Popular recreation sites on the western section of the range include the Baker Peaks pavilion area, Fortuna Mine, Tinajas Altas, and El Camino del Diablo. Camping for up to 14 days is allowed. Recreation is permitted as an incidental or secondary use, subject to the primary military missions of the range as well as resource management and safety considerations. There are sections of the western portion of the range that are continually closed to any recreation use because of military activities and resource protection.

Arizona Game & Fish Department

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. In 1994, legislation was passed banning trapping on public land in the state of Arizona. Hunttable species on the BMGR include big game such as bighorn sheep, deer, and javelina, and small game such as rabbits, quail, and dove. The majority of this hunting activity occurs in the eastern portion of the BMGR.

The AGFD has established four Game Management Units (units) within the BMGR, two of which are within the Cabeza Prieta NWR. The two units within the Cabeza Prieta NWR are limited to bighorn sheep hunting and only a few hunting permits are issued there each year. The remaining units cover the rest of the BMGR and some land adjacent to the BMGR. While these units are open to hunting and trapping, trapping is only legal on private land. Within the BMGR, State Route 85 serves as the dividing line between the two units. In 1995, there were 108 permits for javelina, 283 permits for deer, and two permits for bighorn sheep issued for the unit east of State Route 85. For the same year, there were 21 permits for javelina, 142 permits for deer, and 3 permits for bighorn sheep issued for the unit west of State Route 85.

3.11.5 Recreation Use and Management in the Vicinity of the BMGR

Recreation opportunities within a 20-mile region of influence of the BMGR are similar to the opportunities within the BMGR shown in Figure 3-8. Recreation areas include national monuments, NWRs, Wildernesses, ACECs, and other recreation sites (Figure 3-24). Recreation opportunity and use are discussed in this section; a broader discussion of these areas can be found in Section 3.4.

National Park Service

Organ Pipe Cactus National Monument and Wilderness, administered by the National Park Service, is located east of the Cabeza Prieta NWR. Although the resources differ, recreation opportunities at the monument are similar to those at the Cabeza Prieta NWR. In 1995, an estimated 414,820 people visited Organ Pipe Cactus National Monument. About 58,500 people stayed overnight at the monument, of which 50,910 camped one night in designated campgrounds and 3,558 camped in the backcountry (Smith 1996). A permit is required to camp in the monument.

Secretaria del Medio Ambiente, Recursos Naturales y Pesca

In Mexico, Reserva de la Biosfera de El Pinacate Y El Gran Desierto de Altar was designated as a biosphere reserve in 1992. 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. The core protective area of El Pinacate y El Gran Desierto de Altar reserve is depicted on Figure 3-24. Recreational opportunities are similar to those offered elsewhere in the region; however, the recreation experience differs dramatically. Similar geology and landscape are not found elsewhere in the region, visitor services are minimal, and the area is remote and undeveloped. Roads are not signed, maintained, or patrolled; require a four-wheel drive vehicle; and may become impassable following rains (Friends of Pronatura 1989).

FIGURE 3-24
RECREATION AND PRESERVATION AREAS IN THE BMGR REGION
11 x 17 B&W

U.S. Fish and Wildlife Service

The Kofa NWR, managed by the USFWS, also offers similar recreation opportunities to that found within the BMGR. The most popular recreation activities within the refuge include hiking, sightseeing, photography, camping, limited rockhounding, and observing nature. Hunting is also allowed within the refuge, but is limited to desert bighorn sheep, deer, cottontail rabbits, fox, and quail, with the appropriate hunting permit obtained from AGFD. No permits are required to enter the Kofa NWR. Visitors may enter the refuge in compliance with all public use regulations, the provisions of any special use permits, and official posted notices.

Bureau of Land Management

Within the region of influence, there are six wildernesses managed by the BLM. Information such as the location and size of the wilderness areas can be found in Section 3.4. Table Top and North Maricopa Mountains wildernesses are the most popular for recreation use. Together, they attract approximately 2,000 visitors a year predominantly associated with day use. In addition, two ACECsXCoffee Pot Mountain and Vekol ValleyXare located within the region of influence; however, they receive limited recreation use. The Juan Bautista de Anza National Historic Trail is an east-west oriented trail that crosses Arizona north of the BMGR. The BLM, in conjunction with the National Park Service, is in the process of marking and managing this trail.

Other Public Land

In Arizona, dispersed recreational activities and opportunities associated with the desert and Colorado River include off-highway vehicle (OHV) use, hiking, camping, rock-collecting, fishing, and boating. The lower Colorado River is a popular recreation destination for people in western Arizona and southern California. In addition to state, county, and private recreation sites, recreation facilities in this area consist of developed and undeveloped BLM recreation sites. Developed sites include Betty's Kitchen and the Imperial Dam Recreation Area. The primary features of these sites consist of picnic areas and developed trails, along with water-based recreation facilities. North and east of the BMGR, public lands are relatively remote, although recreation activity does occur. The BLM operates the Painted Rock Petroglyph Campground, located 1.5 miles south of the Gila River, about 20 miles northwest of Gila Bend. The site has archaeological interest and consists of developed campsites, picnic areas, and restrooms. Most of the dispersed recreation is in the form of OHV use, hiking, remote camping, sightseeing, rock collecting, hunting, and recreational mining. Public lands in the vicinity of the BMGR are classified as "limited" relative to OHV use, which means that vehicles may only be used on existing roads and trails.

A major component of the BLM California Desert Conservation Area (CDCA) Plan considers recreational land use. It has been estimated that visitors spend more than 20 million visitor days a year in the CDCA, making it one of the most heavily visited recreation areas in the United States. Recreation activities include hiking, hunting, camping, rock collecting, land sailing,

sightseeing, and OHV use. In the vicinity of the BMGR, OHV use is the predominant use of CDCA lands. The CDCA plan designates public lands as open, limited, or closed to OHV use. Areas designated as open to intensive OHV use include the Imperial (or Algodones) Sand Dunes. These sand dunes are the largest mass of sand dunes in California and extend for more than 40 miles along the eastern edge of the Imperial Valley. OHV use is permitted on more than two-thirds of the sand dunes, or about 118,000 acres.

State and Other

AGFD administers the Painted Rock Wildlife Area, located northwest of Gila Bend; Quigley Pond Wildlife Area, located north of Tacna; and the Mitty Lake Wildlife Area, located northeast of Yuma. The primary purpose of these areas is for wildlife management, and the primary 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. Two rest areas with picnic and restroom facilities, maintained by the Arizona Department of Transportation, are located along Interstate 8 near Sentinel and west of Dateland, Arizona.

3.12 HAZARDOUS MATERIALS AND WASTE

3.12.1 Introduction

The BMGR affected environment associated with hazardous materials and waste is related to the past and present hazardous materials use and hazardous waste disposal practices on the range. Current Air Force programs and practices are designed to control hazards to human health, welfare, and the environment and assure compliance with federal, state, and local statutes and regulations.

Potential waste generation areas on the BMGR include septic fields, suspected landfills, aircraft mishaps, fuel storage tanks for emergency generators, electrical transformers, and facility operations shops. In addition, hazardous wastes may have been generated during past mining operations on the BMGR. Hazardous materials stored and transported on the BMGR have included solid wastes; petroleum, oils and lubricants (POLs); various chemicals (paints, thinners, cleaning solvents); pesticides and herbicides; and ordnance. Waste processing on the BMGR has included wastewater treatment lagoons, incinerators, septic systems, and the removal and treatment of munitions.

Hazardous constituents contained in munitions delivered to the BMGR air-to-ground ranges are usually consumed in a series of chemical reactions that occur upon detonation. Occasionally the munitions do not fully detonate or do not detonate at all. If EOD teams do not recover these undetonated munitions and the munitions case is damaged or eventually corrodes, the hazardous constituents could potentially contaminate the environment.

All non-hazardous training or target debris is recycled or disposed of in approved off-range

landfills.

3.12.2 Management of Hazardous Substances

Oversight of hazardous waste issues is provided primarily by ADEQ. ADEQ is fully authorized to enforce Subtitle C of RCRA. Responsibility for the management of hazardous substances, materials, and wastes on the BMGR lies with the Environmental Flight at the 56th FW, Luke AFB for the Air Force section of the range and the MCAS Yuma Environmental Department for the Marine Corps section of the range.

Installation Restoration Program

To evaluate activities involved in past handling of hazardous materials, the Air Force developed the Installation Restoration Program (IRP) in the late 1970s. In 1984, Congress made it a part of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA, 42 USC 6901 et seq.) and the Superfund Amendments and Reauthorization Act (SARA), Title III (42 USC 9601 et seq.). The IRP addresses the identification, investigation, and remediation of past DoD waste releases at United States military installations and consists of the following stages:

- # preliminary assessment/site inspection
- # remedial investigation/feasibility study
- # record of decision (or decision document)
- # remedial design/remedial action
- # site close-out

A decision of no further response action planned (NFRAP) may occur at any point in the process, provided that adequate information is present to support the recommendation. A decision document must be published for public and regulatory agency review to support the decision for NFRAP and site close-out.

Preliminary Assessment Findings

As part of the IRP process, a preliminary assessment (PA) of the BMGR was conducted by Luke AFB in 1992 (Science and Technology, Inc. 1992). The purpose of the assessment was to identify and evaluate the potential for environmental hazards related to past handling procedures, disposal practices, and generation of hazardous material on the BMGR. The PA originally identified 218 possible Areas of Concern (AOCs). Of these 218 possible AOCs, 130 required no further action and were closed. The remaining 88 sites were determined to be AOCs.

At the time the PA was completed, 45 of the 88 AOCs were active operations and were managed under state and federal RCRA regulations. The Air Force funds the management and monitoring

of these sites under its environmental compliance program.

The other 43 AOCs were declared IRP sites. Investigation and cleanup of IRP sites are funded from a specific environmental restoration appropriation and are driven by CERCLA.

EPA reviewed the findings of the preliminary assessment and requested additional inspection at 12 of the 43 IRP sites. These sites were further investigated in an October 1995 Site Inspection (SI). All sampling methods, locations, and analyses used during the investigation followed site-specific EPA direction (Dames & Moore 1995). A summary of the findings of the SI are provided below under the heading Site Inspection Findings. In October 1997, EPA completed its review of the SI report and decided that no further action is warranted for 11 sites included in the SI. EPA also determined that conditions at the BMGR site do not pose a significant threat to human health or the environment, and therefore does not warrant placement on the National Priorities List (Curnow 1997).

Decision documents have been prepared for 42 of the 43 IRP sites, signifying that the site has been closed and no further investigation or remediation is required. The remaining site is currently undergoing remediation.

Of the 45 AOCs that were active at the time of the preliminary assessment, 29 are still active. The remaining 16 sites, primarily consisting of fuel storage tanks and munitions burial areas, are no longer active or in operation. During the time that the sites were still active, Air Force hazardous substance management programs were in place with policies for properly closing sites. With the exception of two underground storage tank (UST) sites at Gila Bend AFAF, no concerns were noted for further investigation at these 16 sites. The actions taken at the two UST sites are summarized under a later section titled Underground Storage Tank Management.

Site Inspection Findings

The 12 sites included in the site inspection were in seven locations on the BMGR—the Gila Bend AFAF, the Ajo Radar Station, a munitions burial area at Range 1, the U.S. Navy Sentinel Test Site, AUX-2, the former napalm burn area at Marine Corps EOD operating area, and Fortuna Mine (Figure 3-25 and Table 3-23). The SI was completed in October 1995 and submitted to ADEQ and EPA Region 9 for review. The SI recommends only one site at the Ajo

FIGURE 3-25
HAZARDOUS MATERIALS/HAZARDOUS WASTE
INVENTORY ON THE BMGR
11 X 17

TABLE 3-23
SUMMARY OF SITE INSPECTION FINDINGS
11 X 8 ½

Table 3-23 (page 2)

Radar Station for further action (SD002, Oil/Water Separator and Outfall). Both the state and EPA concur with the findings of the SI. What follows, unless otherwise stated, is a summary of the Site Inspection Report for the BMGR (Dames & Moore 1995).

Gila Bend Air Force Auxiliary Field

Gila Bend AFAF is responsible for emergency aircraft recovery and provides management, maintenance, and operation support for the eastern segment of the BMGR. Facilities at Gila Bend AFAF include range operations, scheduling, and dispatch offices; vehicle maintenance shops; aircraft hangars and runways; housing; and associated buildings. Although no one is presently living at this installation, as many as 500 personnel had been stationed there in the past. Hazardous materials used or stored at the Gila Bend AFAF have included paints, thinners, cleaning solvents, ordnance, pesticides and herbicides, and POLs. Two areas that could have potentially been impacted by the use of hazardous materials at Gila Bend AFAF, a plumbing/metal shop and a former fire training area, were included in the site inspection.

During the site inspection, soil sampling and analysis performed at both sites found no evidence of contamination from hazardous material or hazardous waste disposal at either area.

Ajo Radar Station

Originally constructed by the Air Force in 1956-1958, the Ajo Radar Station is located at Childs Mountain in the northwest corner of the Cabeza Prieta NWR (see Figure 3-25). Operation of the radar station terminated in 1971 and the facility was abandoned. The only remaining operation is a GRMDS instrument site located at the mountain summit. Hazardous materials use at the Ajo Radar Station included paints, thinners, cleaning solvents, pesticides, herbicides, and POLs. In addition, asbestos containing building material was removed from the site in October 1994 during the hazardous materials removal project that was completed as part of the demolition plans for the facility. An operations center building at this site that has not yet been demolished is also known to contain some asbestos material. Luke AFB is requesting funds to demolish this building. The first potential funding period would be FY 2001. Prior to demolition, asbestos containing material will be abated, handled, and disposed of in accordance with federal and state laws and regulations.

The entire former cantonment area has been cleared and reclaimed. Native grasses were used for revegetation and there is no indication of the former structures. Four areas that could have potentially been impacted by the use of hazardous materials at the Ajo Air Station have been further evaluated through the IRP program. These sites include an incinerator, oil water separator, suspected landfill, and septic tank and associated leachfield.

The incinerator was used to burn solid wastes generated at the station. During an October 1994 hazardous materials removal project, a total of six 55-gallon Department of Transportation

(DOT) approved drums were filled with lead contaminated ash generated from the incinerator and removed from the site for disposal in a hazardous waste landfill. No evidence of contamination from hazardous materials or hazardous waste disposal was identified at this area during the site inspection.

Soil at the site of the oil/water separator revealed evidence of contaminants discharged from the outfall of the separator. The site was recommended for further investigation based on the elevated levels of chlordane and lead in the soil samples. The site is currently undergoing remediation.

The suspected landfill was also reportedly once used as a trap and skeet range. A geophysical study conducted during the site inspection determined the area to be a natural depression that had been filled in with soil (free of trash) to make an even grade. Soil sampling at this location revealed low levels of polyaromatic hydrocarbons (PAHs); however, the PAH contamination appeared localized with little or no potential for migration or exposure. No remediation or further investigation was recommended at this location.

Soil sampling and analysis were also performed at the septic tank and associated leachfield. The results did not identify evidence of contamination from hazardous materials or hazardous waste disposal.

Range 1 Munitions Burial Area and Others Throughout the BMGR

During periodic range clean-up, EOD personnel clear munitions from the surface of training ranges. Any live unexploded ordnance or spotting charges EOD personnel come into contact with are detonated to ensure that all explosives have been spent. Although some of the ordnance used in training on the BMGR contains small amounts of potentially hazardous constituents, most of them are released upon impact and/or detonation. The components of munitions that remain after detonation (primarily metal castings) are referred to as munitions residue.

Prior to 1993, munitions residue was buried in several pits dug in designated areas marked with signs. Records indicate that munitions burial areas are located on the four manned ranges and the three tactical ranges on the eastern section of the BMGR. A 1997 field inventory identified 30 munitions burial areas in the eastern section of the range (see Figure 3-25). The inventory notes that additional areas may exist that could not be identified because vegetation has re-grown over the areas and obscured them and/or because current BMGR road maps are inadequate. Less complete records indicate that there may be additional burial areas in the vicinity of the Marine Corps EOD operating area on the western section of the range (U.S. DoD, Luke AFB 1997). Since 1993, munitions residue collected on the training ranges is transported to designated Range Munitions Consolidation Points (RMCPs) where it is secured for sale as a recyclable good. During the site inspection a single munitions burial area, located along the strafe line at Range 1, was chosen as a representative munitions burial area site. Soil sampling and analysis performed at this site identified no evidence of contamination resulting from hazardous material or hazardous waste disposal. Prior to the site inspection, soil sampling and analysis at four spent munitions disposal areas also found the soil at these areas to be non-hazardous. This

investigation was performed in 1986 by the Arizona Department of Health Services and Luke AFB. Based on this investigation, the Arizona Department of Health Services and ADEQ determined that the munitions burial areas on the range were solid waste and not hazardous waste sites (U.S. DoD, Luke AFB 1997).

U.S. Navy Sentinel Test Site

The U.S. Navy Sentinel Test Site was the location of two sites of concern included in the site investigation. The Sentinel Test Site consisted of a tower site and an antennae site located in the same general area, near Sentinel (see Figure 3-25). The tower site was used by the U.S. Navy from 1945 to 1957 and by the U.S. Army until the early 1970s for testing radio wave propagation. The antennae site was acquired by the Navy in 1948. The antennae was built in 1967 and was used until 1980. A trash dump was identified as a potential problem area at the antenna site; however, results of soil sampling identified no evidence of contamination from hazardous materials or hazardous waste disposal in the area. Likewise, soil sampling at a suspected waste disposal area at the tower site identified no evidence of contamination from hazardous materials or hazardous waste disposal in the area.

Auxiliary Airfield 2

East of the runway at AUX-2 is an area of miscellaneous debris, mostly scrap metal and lumber, where buildings were previously located. Neither a well nor an UST reported to be at this site could be located during the site inspection. Soil sampling at this site identified no evidence of contamination from hazardous materials or hazardous waste disposal.

Former Napalm Burn Area

The former napalm burn area, located within the MCAS Yuma EOD operating area was used for the disposal of an unknown amount of napalm from around 1970 to 1988 (see Figure 3-25). Disposal practices consisted of placing drums of unstable napalm in a pit, detonating and burning them, and then covering them with native soil. Soil sampling and analysis performed during the site investigation found total recoverable petroleum hydrocarbons (TRPH) to be the only constituent of concern. Although TRPH exceeded both the background concentration and the then current 100 mg/kg ADEQ-suggested action level in one sample, the area of contamination was found to be confined to a very small area only two to three inches in depth. No further investigation was recommended at this site.

Fortuna Mine

The Fortuna Mine was operated sporadically from 1848 to 1941 (before the BMGR was established) and produced copper, silver, and gold ores. It is located on the western section of the range in the Gila Mountains (see Figure 3-25). It is reported that a cyanide plant was located at

the site for processing ore. Today, a tailings pile of crushed and processed ore remains at the mine and covers an area of approximately three to five acres. Soil sampling and analysis performed during the site inspection did not indicate contamination from hazardous materials or hazardous waste at this site.

3.12.3 Other Management, Investigation, and Remediation Sites

In addition to the IRP sites included in the site investigation, there have been several other sites on the BMGR that have required hazardous materials or hazardous waste management, investigation, and/or remediation. These sites are described below.

Underground Storage Tank Management

Currently there are three active USTs at the Gila Bend AFAF. These tanks have been recently reviewed to determine whether upgrades would be required for compliance with ADEQ standards. Minor upgrades were recommended and are currently being performed (Rothrock 1998).

Two USTs, identified as areas of concern in the preliminary assessment, have required further management, investigation, and remediation. In 1992, during the removal of one of these USTs, an estimated 50 gallons of fuel were spilled. The stained soil was immediately removed and stored on plastic sheeting. Soil sampling performed at the location of the release in September 1994 and additional soil borings in June 1995 did not identify petroleum hydrocarbons. Based on these findings no further investigations or remediation were performed at this site. At the second UST site, soil contamination above the level requiring action was identified. This UST was replaced with an aboveground storage tank in 1996. Soil contaminated with total petroleum hydrocarbons will be excavated and properly disposed of to obtain site closure.

Munitions Treatment Facilities

Treatment of munitions through open burning/open detonation has occurred at two munitions treatment facilities on the BMGR. The Air Force has an interim status RCRA permit for these facilities. The Air Force munitions treatment range, located on the eastern section of the range, is operated by Luke AFB. This facility is currently going through closure activities (Thomas 1997). The Marine Corps OB/OD facility located within the EOD operating area on the western section of the range is operated by MCAS Yuma (see Figure 3-25). The BMGR interim RCRA permit is currently being modified to reflect current operations at the Marine Corps facility.

Munitions treatment facilities provide an area to support thermal treatment of munitions that are determined to be obsolete, out-dated, or unserviceable. Ordnance and other explosives from local manufacturing facilities have also been treated at these locations. Treatment of munitions larger than 20 mm in diameter is accomplished by detonation in an open pit located in an exclusion zone. Following treatment, metal casings and fragments are typically all that remain.

Treatment at the eastern facility was limited to burning munitions in a treatment vessel. The ash residue was analyzed and found to be non-hazardous. This treatment facility has ceased operation and is currently undergoing closure with ADEQ. Treatment at the western facility is limited to detonation. Past burning treatment pits located there are currently undergoing closure with ADEQ.

3.13 NATURAL ENVIRONMENT OVERVIEW

The BMGR is located in the core of the Sonoran Desert, which encompasses approximately 100,000 square miles and includes the southern half of Arizona, southeastern California, most of the Baja California peninsula, the islands of the Gulf of California, and much of the state of Sonora, Mexico. Once considered by many as a barren wasteland interrupted only occasionally by a stately cactus, the Sonoran Desert is now recognized as the most diverse desert in North America. It is characterized by its hot, dry climate and its unique and varied landforms, vegetation, and wildlife.

The geologic base that supports the Sonoran Desert evolved over millions of years of volcanic eruption, uplift, mountain building, and faulting of the earth. Precipitation-induced runoff and wind proceeded to fill basins with sediment and produced alluvial ground-water aquifers and occasional surface waters. The landscape of today evolved about 4,000 to 8,000 years ago and varies from rugged mountains and broad alluvial valleys to volcanic craters, sweeping dune fields, and the coast and islands of the Gulf of California. This diverse landscape combined with low precipitation, high temperature, low humidity, and high evaporation rates has, in part, determined the diversity of Sonoran Desert plants and wildlife.

The Sonoran Desert is dependent on an intricate ecological balance. Many species of plants and wildlife have developed adaptations for survival in the seemingly inhospitable desert. These adaptations involve interrelationships among plant and animal species and the physical

environment. The saguaro cactus, an icon of the Sonoran Desert, is an example of survival adaptation and these complex interrelationships. The saguaro has a thick, waxy, pleated outer skin that reduces transpiration and expands and contracts with the amount of water it is storing. It also has a shallow root system that provides support and allows the saguaro to take advantage of very light precipitation. Saguaro reproduction is dependent on bats, insects, and birds for pollination and its germination is often accomplished through digestion by mammals. Saguaro seedlings require protection from frost and intense sunlight and often grow in rocky soil within the shelter of protecting plants such as palo verde and mesquite trees. In turn, the mature saguaro provides shade and protection for small mammals, reptiles, and birds. When a saguaro dies, the carcass of the cactus continues to provide valuable habitat for such species for many years.

Although many desert species can be long-lived, such as the creosote bush and the desert tortoise, the ecological system upon which they are dependent can be quite vulnerable. Desert environments are easily disturbed by human activities and are slow to recover because the harshness of the desert climate severely reduces the resilience of desert communities.

The establishment of the BMGR has had the initially unplanned effect of protecting what is today one of the largest and best preserved remaining tracts of Sonoran Desert. The geology and water resources of the range are characterized by rugged mountains, broad valleys, sand dunes, and natural surface water catchments. In terms of biological resources, more than 275 representative plants may occur on the range and at least 56 species of mammals, more than 150 species of birds, 6 species of amphibians, and 44 species of reptiles have been reported as represented on the range. Of note, two federally endangered species, the Sonoran pronghorn and the lesser long-nosed bat, are known to occur on the range. Other species of concern known to occur on the range include the California leaf-nosed bat, peregrine falcon, flat-tailed horned lizard, Cowles fringe-toed lizard, desert tortoise, acuzacactus, sand cholla, blue sand lily, and Kearney sumac.

The components of the BMGR natural environment—earth, water, air, and biological resources—are described in the following sections of Chapter 3.0.

3.14 EARTH RESOURCES

3.14.1 Regional Geology

The BMGR is located in the Desert portion of the Basin and Range Physiographic Province of Arizona. This province is characterized by steep, rocky, discontinuous subparallel mountain ranges which trend northwest to southeast separated by broad, gently sloping to nearly flat, deep,

alluvial filled valleys or basins (Figure 3-26). Most of the mountain ranges have been formed by faulting, folding, or volcanism. The mountain ranges are formed of Precambrian to Tertiary aged igneous, metamorphic, and sedimentary rocks (Table 3-24). Valley fill materials consist of Quaternary to Holocene unconsolidated to moderately consolidated silts, clays, sands, and gravels (Arizona Geological Survey 1988). Alluvial deposits vary from less than 100 feet in some basins to more than 10,000 feet in the Yuma Desert in the western portion of the BMGR (Oppenheimer and Sumner 1980). Quaternary and Holocene deposits include colluvial (landslide and talus), alluvial (stream), lacustrine (lake), pluvial (ephemeral stream), and eolian (sand dunes) deposits. Extensive basalt flows occur in the Ajo, Pinacate Mountain, and Sentinel volcanic fields. Sand dunes, the result of wind-blown fine sand and silt deposits, occur in the Mohawk and Yuma (or Fortuna) valleys. Another sand dune area, the Pinta Sands, occurs near the Pinacate Mountain Volcanic Field. A rocky desert pavement occurs where fine alluvial material has been removed by wind erosion. Alluvial fans and bajadas, fan-shaped depositional features formed from alluvial and colluvial deposits, commonly occur along portions of the mountain bases. The modern landscape is primarily the result of Tertiary tectonic and on-going erosional events.

Elevations range from about 200 feet above mean sea level in the western part of the BMGR to the south of Yuma, to nearly 4,100 feet in the Sand Tank Mountains. Relief on the BMGR between valley bottoms and mountain peaks is typically between 1,000 and 2,000 feet.

The BMGR is in the Southern Basin and Range seismic source zone which extends from Mexico into southern California and includes most of southwestern and central Arizona. A maximum magnitude earthquake of 6.0 has been estimated for this seismic source zone (Bausch and Brumbaugh 1994). The BMGR is in a tectonically stable area with low levels of seismic (or earthquake) activity and few active faults. The most prevalent seismic activity in the region is generally from along the Colorado River area and from a northwest to southeast trending zone through Yuma that includes the San Andreas and related faults. Known active faults in the region include the Algodones Fault near Yuma and the Sand Tank Fault near Gila Bend.

3.14.2 Mineral Resource Overview

One of the earliest important mineral producing areas in Arizona occurred in the southwestern part of the state. Numerous large and small mining and placer operations that were first found and prospected during the mid- and late-1800s are located on and adjacent to the BMGR. The area contains numerous varied occurrences and deposits of metalliferous and nonmetalliferous minerals as well as energy resources. Several metallic mining districts are located on or near the BMGR. Mining districts are determined based on type of mineralization and age of the mineral resource deposits. Mining was active on portions of the BMGR until the area was originally withdrawn for military use in 1941. Mining and mineral leasing have been excluded from the

Table 3-24
Geologic Time Scale

FIGURE 3-26
11 X 17 B&W
BMGR GEOLOGY/MINERAL RESOURCE ASSESSMENT

range since the 1941 withdrawal. Since mineral prospecting and mining have been excluded from the BMGR for such a long time, modern geologic and mineral resource information about the range is limited. The major mining operations located in Ajo began after the 1941 withdrawal.

The Fortuna mining district covers the central part of the Gila Mountains (see Figure 3-26). The district includes only one major economic mineral deposit: gold with minor amounts of copper. Gold, silver, and copper were mined in the La Posa mining district (including Wellton Hills), and the Frisco mining district in the Copper Mountains. Part of the Mohawk District, located in the Mohawk Mountains, occurs on the BMGR. Several other districts are adjacent to the BMGR including Yuma, Dome, Laguna, Big Chimney, Muggins, Vinegarroon, Ajo, Ajo Cornelia, Growler, and Quitobaquito. Tungsten, molybdenum, beryllium, mica, uranium, thorium, rare earths, niobium, and tellurium are some of the other mineral resources on or adjacent to the BMGR. Several known uranium deposits occur in the area including in the northwest corner of the Cabeza Prieta Mountains, in the Agua Dulce Mountains, and near Ligurta, Arizona adjacent to the Gila Mountains (Keith 1969, 1978a and b; Keith et al. 1983; McCrory and O'Haire 1965).

Oil and gas exploration has occurred in the Yuma area outside of the BMGR. Several significant exploration wells drilled since 1980 in the San Luis-Fortuna Basins near Yuma have total depths of approximately 5,000 to 9,000 feet. Exxon drilled to a depth of 11,494 feet in the San Luis Basin to the south of Yuma. These holes proved to be dry and were abandoned. The geometry, location, and stratigraphy of these basins indicate they may have formed adjacent to the very prolific Los Angeles, Ventura, and other California Miocene-Pliocene marine basins which were subsequently displaced northward along the San Andreas fault system to their present positions (Nations et al. 1989).

3.14.3 Mineral Resource Potential

There is a requirement to conduct a mineral resources analysis for lands proposed for withdrawal as set forth in 43 CFR 2310.3-2. A Mineral Potential Report (ARCADIS Geraghty & Miller 1998) was completed for the BMGR under the direction of the BLM. This Mineral Potential Report presents an assessment of the potential for energy and mineral resources that may be located on the BMGR. The assessment was based on available geologic, geochemical, geophysical, and remote sensing data; historic production data; as well as information on mines and mineral resource occurrences in similar areas.

The resource reserve classification system from BLM Manual 3031 (Energy and Mineral Resource Assessment) and Manual 3060 (Mineral ReportsXPreparation and Review) serve as guidance in determining the mineral resource potential of the BMGR. The classification system is based on the level of mineral resource potential and level of certainty. Levels of resource potential have been designated as not determined, no, low, moderate, or high. Levels of Certainty have been assigned designations of A (no adequate indication), B (suggestive indication), C (good indication), or D (clear indication). All of the mineral potential evaluations are based on delineation of strongly favorable (high probability) criteria and weakly favorable (lower probability) criteria. The mineral potential report assessed 30 tracts within the BMGR based on geographic distinctiveness (see Figure 3-26). The tracts evaluated were (in alphabetical order):

- | | |
|---|------------------------------------|
| # Agua Dulce Mountains and Quitobaquito Hills | # Aguila Mountains |
| # Aztec Hills | # Bryan Mountains |
| # Cabeza Prieta and Tule Mountains | # Childs Mountains |
| # Childs Valley and Valley of the Ajo | # Copper Mountains and Baker Peaks |
| # Crater Range | # Gila Bend Plain |

- # Gila Mountains
- # Growler Mountains
- # Lechuguilla Desert
- # Midway Area and Batamote Mountains
- # Mohawk Valley
- # San Cristobal Valley
- # Saucedo Mountains
- # Sentinel Volcanic Field
- # Tinajas Altas Mountains
- # Wellton Hills and Wellton Area
- # Granite Mountains
- # Growler Valley
- # Little Ajo Mountains
- # Mohawk Mountains
- # Pinacate Mountain Volcanic Field
- # Sand Tank Mountains and Vekol Valley
- # Saucedo Valley
- # Sierra Pinta Mountains
- # Tule Desert
- # Yuma Desert

Table 3-25 is a summary of potential mineral and energy resources based on the geographic areas within the BMGR that were identified in the Mineral Potential Report (ARCADIS Geraghty & Miller 1998).

TABLE 3-25 SUMMARY OF MODERATE TO HIGH POTENTIAL MINERAL RESOURCES ON THE BMGR			
Geographic Area ¹	Potential Resource	Level of Resource Potential	Level of Certainty*
Agua Dulce Mountains and Quitobaquito Hills	Tungsten Veins	Low-Moderate	C
	Molybdenum	Low-Moderate	B
	Gold-Silver Veins	Moderate	C
	Rare Earth Elements	High	C
Aguila Mountains	None Identified	X	X
Aztec Hills	None Identified	X	X
Bryan Mountains	None Identified	X	X
Cabeza Prieta and Tule Mountains	Gold-Silver Veins	Moderate	C
Childs Mountains	None Identified	X	X
Childs Valley and Valley of the Ajo	None Identified	X	X
Copper Mountains and Baker Peaks	Gold-Silver Veins	Moderate	C
Crater Range	Tin	Moderate	C
Gila Bend Plain	Geothermal	Low to Moderate	B
Gila Mountains	Gold-Silver Mica, Garnet, Marble, Zeolites, and Aggregate	Moderate	C
		High	C
Granite Mountains	None Identified	X	X
Growler Valley	None Identified	X	X
Growler Mountains	Mica	High	D
Lechuguilla Desert	None Identified	X	X
Little Ajo Mountains	Mica	High	D
Midway Area and Batamote Mountains	None Identified	X	X
Mohawk Mountains	Molybdenum	Moderate	C
	Pegmatites	High	D
	Tungsten	Moderate	C
	Porphyry Copper	High	C
	Polymetallic Replacement Deposits	Moderate	B
Mohawk Valley	Specialty Sand	High	A

**TABLE 3-25
SUMMARY OF MODERATE TO HIGH POTENTIAL MINERAL
RESOURCES ON THE BMGR**

Geographic Area ¹	Potential Resource	Level of Resource Potential	Level of Certainty*
Pinacate Mountain Volcanic Field	Geothermal	Low to Moderate	B
San Cristobal Valley	None Identified	X	X
Sand Tank Mountains and Vekol Valley	Porphyry Copper Wollastonite	Moderate Moderate	C C
Sauceda Mountains	Tin Strontium Gypsum	Moderate Moderate Moderate	C C C
Sauceda Valley	Celestite	Moderate	D
Sentinel Volcanic Field	Geothermal	Low to Moderate	B
Sierra Pinta Mountains	None Identified	X	X
Tinajas Altas Mountains	None Identified	X	X
Tule Desert	None Identified	X	X
Wellton Hills and Wellton Area	Gold-Silver Veins Disseminated Gold	Moderate Moderate	C C
Yuma Desert	Geothermal Specialty Sand	Moderate to High High	C A

Source: ARCADIS Geraghty & Miller 1998b

1. Refer to Figure 3-26 for geographical areas.

* Levels of Certainty

A = no adequate indication

B = suggestive indication

C = good indication

D = clear indication

X = not applicable

Known and potential energy resources (coal, oil and gas; geothermal; and uranium and thorium) also were evaluated within the BMGR. There are no natural gas production wells within the BMGR. The future discovery of economically viable oil or gas reservoirs (low Level of Potential with a Level of Certainty C) is considered unlikely based on the geologic conditions of the BMGR. There are several geothermal tracts with the potential for low-temperature geothermal wells. One area west of the Gila Mountains in the Yuma Desert has a moderate to high Level of Potential and a Level of Certainty C. Other potential geothermal tracts occur south of Gila Bend in the Gila Bend Plain (low to moderate Level of Potential with a Level of Certainty B), in the vicinity of the Pinacate Mountain Volcanic Field (low to moderate Level of Potential with a Level of Certainty B for hot, dry rock geothermal) and in the Sentinel Volcanic Field (low to moderate Level of Potential with a Level of Certainty B).

Uranium and thorium deposits occur within several mineral tracts of the BMGR. The Level of Potential is low with a Level of Certainty B for the discovery of any potentially valuable uranium and thorium deposits.

Non-metallic minerals include common variety minerals, industrial minerals, and gemstones. Various common variety minerals occur throughout the BMGR.

Strategic and critical minerals known to occur on the BMGR include mica, silver, quartz crystals, tantalum group minerals, and tungsten ore. The Strategic and Critical Materials Stock Piling Act (Title 50 of USC 98) mandates that a stock of strategic and critical materials be maintained to decrease and preclude, where possible, dependence on foreign sources of supply in times of national emergency.

Based on information provided by the BLM, there are no active unpatented mining claims or mill sites, mineral leases, mineral material sale sites, or other valid existing rights within the BMGR. There is no active mining. According to Arizona State Land Department records, there are no state lands, mineral leases, or mining permits on former state lands within the boundaries of the BMGR. The former state lands within the boundaries of the BMGR were acquired by the Air Force in 1998 (ARCADIS Geraghty & Miller 1998b).

3.14.4 Soils

The soils throughout the BMGR area are quite variable ranging from fine-grained sands and silts on the valley floors to very gravelly soils in the mountainous regions. 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. Rill and gully erosion are also common in some of the valleys. In some ground support locations, years of repeated use has caused considerable ground disturbance and has led to the creation of "moondust" from pulverized soils. These soils have become highly erodible due to excessive use and are subject to increased erosion when disturbed.

The physiochemical characteristics of the soils affect susceptibility to water and wind erosion, infiltration and permeability, available water capacity, salinity, alkalinity, and pH. These factors, in part, are used to determine suitable management and land use practices for various areas.

The soils on the BMGR, including those in the Cabeza Prieta NWR, have been mapped by associations in a variety of soils surveys for this area (Figure 3-27). A comprehensive soil survey is not available for the area. However, a map of soil associations was derived from the Natural Resources Conservation Service (NRCS) (formerly Soil Conservation Service[SCS]) Yuma and Pima counties soil surveys (SCS 1974a,

1974b, 1980), a soil survey of Organ Pipe Cactus National Monument (SCS 1972), and a soil survey of the Gila Bend-Ajo Area (NRCS 1997). A portion of the soil mapping was completed for the Natural Resources Management Plan for Luke Air Force Range (U.S. Air Force 1986). Erosion hazards were determined by NRCS for the soil map units in the soil surveys and are used to predict a soil's susceptibility to accelerated erosion when disturbed. Descriptions of the soil map units and associations are presented in Table 3-26 and locations are shown on Figure 3-27.

TABLE 3-26 SOIL MAP UNITS		
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, very gravelly loams # on alluvial fans and drainageways	slight	none
Laveen-Rillito Association # loams, gravelly sandy loams, 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, rock outcrop # on low mountains, hills, and mountain ridges	slight	none
Tremant-Coolidge-Mohall Association # gravelly loam, sandy loam, sandy clay loam # on alluvial fans and low terraces	slight to moderate	none
Superstition-Rositas Association # loamy fine sand, fine sand # on plains, mesas, and terraces, sand dunes	slight	severe
Source: SCS 1972, 1974a and b, 1980; U.S. Air Force 1986; NRCS 1997		

3.15 WATER RESOURCES

3.15.1 Introduction

Surface water resources within the BMGR are very limited. The presence of surface water is typically dependent on the season and recent precipitation events. Surface water catchments include natural rock depressions (referred to as “tinajas”), sand tanks (saturated sand depressions), charcos (pools within adobe flats and washes), playas (closed basin drainages), and/or springs and seeps.

The principal rivers in the region lie outside of the BMGR. The Colorado and Gila rivers drain extensive watersheds, which include much of the intermountain west and southwestern United States. Most of the water in these rivers is diverted for agriculture and municipal purposes before it reaches the BMGR region.

Southwestern Arizona is in the Basin and Range Lowlands Hydrogeologic Province. The area has high summer temperatures, moderate winter temperatures, and low rainfall and relative humidity. Rainfall is generally less than 5 inches per year for the military sub-ranges 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 1998a). Most of the annual precipitation occurs in mid-winter and in the late summer, often as intense rainfall. Surface runoff carries water to closed alluvial basins or into streams and rivers. Evaporation potential exceeds precipitation. Annual evaporation rates range from greater than 86 inches along the Colorado River to about 72 inches along the eastern part of the military ranges (Montgomery and Harshbarger 1989).

There is a requirement to conduct a water resources analysis for lands proposed for withdrawal as set forth in 43 CFR 2310.3-2 if the application states that the use of water will be necessary to fulfill the purposes of the requested withdrawal, or the extension or modification of that withdrawal. Water resource usage will be necessary to continue operations on the BMGR. The water resources report is required to address rights, acquired or to be acquired, to the use of water in conformity with applicable state laws and procedures relating to the control, appropriation, use, and distribution of water. A Water Resources Assessment was completed for the BMGR including the Gila Bend AFAF and Cabeza Prieta NWR (ARCADIS, Gehrarty & Miller 1998a).

3.15.2 Surface Water

The BMGR is located in portions of the Lower Gila, Yuma, and Western Mexican Drainage hydrologic basins (Arizona Department of Water Resources [ADWR] 1997). Surface water drainage on the BMGR is outward from the mountain ranges and, for most of the area, ultimately

FIGURE 3-27
SOILS
11 X 17 B&W

northward by numerous intermittent washes into larger washes that flow to the Gila River, which in turn flows into the Colorado River (Figure 3-28). 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 of the surface water drainage, primarily in the southern portion of the BMGR, is southward by numerous intermittent drainages into Mexico (see Figure 3-28). A few closed drainages on the range empty into playas that hold water only temporarily after substantial rains. No surface water on the BMGR is used for military purposes.

Surface water catchments present on the BMGR have typically formed in tinajas, sand tanks, charcos, playas, springs, and seeps (U.S. Air Force 1986). There are approximately 70 artificial or enhanced natural catchments present throughout the BMGR to retain intermittent runoff, primarily for the benefit of wildlife (ARCADIS Geraghty & Miller 1998a).

Tinajas and sand tanks typically form in stream channels. Some of the larger tinajas may retain water year round. Playas within the BMGR are of importance to migratory birds and other wildlife. There are several relatively larger playas (Las Playas, Dos Playas, and Pinta Playa) and other smaller unnamed playas on the BMGR. Natural springs and seeps, typically found in some of the mountains within the BMGR, are usually dry most of the year. Several have water from infiltration into the rock or ground surface following a rainfall event. There are two perennial springs within the BMGR: Dripping Springs on the east side of the Gila Mountains and Agua Dulce Spring located on the southeast flank of the Agua Dulce Mountains (ARCADIS Geraghty & Miller 1998b).

The Federal Emergency Management Agency (FEMA) provides 100-year floodplain and flood hazard boundary maps as part of the Flood Insurance Rate Map program. Although there are flood hazards on the BMGR along the major washes, FEMA has not delineated 100-year floodplains on the BMGR. Flash flooding and flooding may occur in the washes as a result of the brief but intense summer monsoonal events or the longer duration winter and spring rainfall events.

Most, if not all, of the intermittent surface drainageways in the BMGR are considered jurisdictional waters of the United States (Geraghty & Miller 1997) and are therefore subject to the Clean Water Act. Activities in and around these jurisdictional waters require adherence to the Clean Water Act and may require Section 401, 402, and 404 permits under the Clean Water Act. The U.S. Army Corps of Engineers and Environmental Protection Agency administer these permits.

3.15.3 Groundwater

The BMGR includes portions of three major groundwater basins: Yuma, Lower Gila, and Western Mexican Drainage within the Lower Colorado River Planning Area (ADWR 1997). The Lower Colorado River encompasses portions of the Colorado River watershed and the tributary Gila River watershed.

Groundwater occurs in both floodplain and basin fill deposits. Streambed or floodplain deposits consist of sand, gravel, cobbles, and boulders which range from about 10 feet thick in the smaller washes to as much as 110 feet thick in the Gila River floodplain. These 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 always be present. Groundwater recharge on the BMGR is from infiltration of rainfall runoff and underflow from upstream and side valleys (ADWR 1997).

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 range from 500 to 2,500 gallons per minute (gpm). No estimates of well yields are available for wells on the BMGR (ARCADIS Geraghty & Miller 1998a).

Groundwater at the BMGR has been found to be of poor quality. Typically it has high concentrations of total dissolved solids (TDS) and fluoride. 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. Shallow groundwater has occasionally been noted, probably occurring in a zone of perched water (ADWR 1997, ARCADIS Geraghty & Miller 1998a).

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 (ARCADIS Geraghty & Miller 1998a) identified 96 wells (ADWRs Groundwater Site Inventory database) and 80 wells (Wetlands and Floodplains Overview Report [Geraghty & Miller 1997]) on the BMGR. 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 (Table 3-27). Two production wells currently supply the U.S. Air Force for needs at the Gila Bend AFAF and field activities at the Manned Ranges (see Figure 3-28). 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

FIGURE 3-28
LOCATIONS OF ADJUDICATED WATER CLAIMS
11 X 17 B&W

TABLE 3-27
SUMMARY OF MILITARY WATER USES ON THE BMGR
11 X 17 B&W

rifle range and tracker shed provide water for construction, maintenance, and dust control. Cannon Air Defense Complex uses one production well for 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 1998a).

3.15.4 Water Rights

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 1998a).

As part of the water resources assessment, future water requirements on the BMGR were estimated based on current demands, except for the Gila Bend AFAP where future use was based on a demand projection model (ARCADIS Geraghty & Miller 1998a). Water rights claims have been filed under the Lower Gila River Adjudication for the Gila Bend AFAP production wells, other BMGR wells, and surface water sources on the BMGR so that these water uses will be included in the adjudication (see Figure 3-28). 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 AFAP, and for future water uses that may be necessary for military needs and for wildlife (ARCADIS Geraghty & Miller 1998a).

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 1998a).

Future military groundwater uses are estimated to be approximately 211 acre-feet per year (nearly 69 million gallons) (Table 3-27). Current annual water usage at the Gila Bend AFAP 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 AFAP 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 AFAP 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.

3.16 AIR QUALITY

3.16.1 Introduction

Data from Yuma, Ajo, Organ Pipe Cactus National Monument, and Gila Bend are used to characterize the climatology of the BMGR airspace region, which includes aircrew training areas that are closely associated with the BMGR. Air quality in this study area is characterized using data from Yuma, Ajo, Casa Grande, and Tucson. Figure 3-29 shows the primary area of focus for the air quality study and the type of data collected from various locations in the region.

The primary factors that determine air quality of a region are the locations of all air pollution sources, the amounts of pollutants emitted, the local meteorological conditions over a period of time, and the types of pollutants emitted.

3.16.2 Climatology/Meteorology

The study area is a vast, arid region covering portions of Yuma, Maricopa, Pinal, 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 elevations reaching 4,000 to 5,000 feet in mountainous regions.

Temperatures in this region are typical of desert climatology, ranging from 30-45 °F during the winter, to more than 100 °F during the summer. Daily temperatures of 90 °F or greater occur approximately 40 to 50 percent of the year. During the summer months, maximum temperatures of 120 °F or greater have been reported. Table 3-28 summarizes the mean temperatures at four locations within or near the study area.

FIGURE 3-29
LOCATIONS OF AIR QUALITY DATA SOURCES IN THE BMGR REGION
8 ½ x 11

TABLE 3-28								
CLIMATOLOGICAL SUMMARY: MEAN TEMPERATURE AND PRECIPITATION FOR THE BMGR VICINITY 1941-1970								
	Temperature (°F)				Precipitation (inches)			
	Yuma	Ajo	Organ Pipe Cactus NM	Gila Bend	Yuma	Ajo	Organ Pipe Cactus NM	Gila Bend
Monthly Mean								
Jan	45-62	43-60	42-59	43-60	0.39	0.70	0.76	0.62
Feb	48-65	47-64	46-63	47-63	0.29	0.53	0.55	0.44
Mar	52-70	51-69	50-67	52-70	0.24	0.82	0.67	0.65
Apr	61-81	61-81	58-78	62-82	0.10	0.33	0.22	0.30
May	69-87	72-88	67-84	74-89	0.01	0.05	0.12	0.10
June	79-95	83-98	77-90	84-99	0.02	0.06	0.11	0.04
July	83-102	84-102	80-98	87-108	0.18	1.36	1.36	0.76
Aug	85-104	83-99	81-95	85-103	0.41	2.46	1.79	1.08
Sept	77-92	79-90	76-88	78-89	0.24	0.75	1.23	0.50
Oct	66-80	68-83	64-76	69-81	0.30	0.51	0.68	0.33
Nov	53-72	54-73	51-67	53-70	0.22	0.55	0.58	0.35
Dec	49-60	51-62	48-59	47-58	0.37	0.83	1.10	0.59
Annual Mean								
	71.1	71.3	69.2	72.1	2.77	8.95	9.17	5.76
Source: Sellers and Hill 1974								

Precipitation in the area is sparse and is limited primarily to rainfall, although traces of snow, sleet, or hail have been reported. Rainfall occurs primarily during the monsoon season from July through early October. Large amounts of warm, moist air moving from the Gulf of Mexico can create heavy thunderstorms across Arizona. However, precipitation amounts diminish in the western portion of the study area near Yuma, as shown in Table 3-28.

Surface winds during the monsoon season primarily originate from the south-southeast or the south-southwest. After the monsoon season, westerly winds prevail.

Atmospheric stability is another important factor of meteorology that determines air pollution concentrations. When the atmosphere is stable, emitted pollutants tend to remain within a few hundred feet of the surface (close to the emission sources), and will begin to diffuse horizontally across the surface. When the atmosphere is unstable, air pollution is free to mix with the atmosphere, and will vertically rise 300 meters (1,000 feet) or more, and be carried away in the prevailing wind. Therefore, the depth of this “mixing” area is very important when considering the impacts of air pollution on the study area.

In the study area, atmospheric stability of the region depends on the season. During the summer, the frequency of stable and unstable conditions of the atmosphere over the study area is relatively equal. The periods of instability are due to the monsoon rains that occur during the summer months. When temperatures fall as winter approaches, stability in the atmosphere becomes more frequent, as lower mid-latitude high pressure tends to be dominant over southern

Arizona and northern Mexico. These observations mean that air pollution is less likely to be released into the atmosphere and be dispersed during the fall and winter months than during the summer months. This then leads to higher concentrations of air pollutants in the winter than during the summer.

3.16.3 Air Quality Regulations

As directed by the federal Clean Air Act, EPA established National Ambient Air Quality Standards (NAAQS) for six “criteria” pollutants. These standards were adopted by the EPA to protect the public health (primary standards) and the public welfare (secondary standards). The six pollutants are: carbon monoxide, nitrogen dioxide, ozone, particulate matter (PM₁₀), sulfur dioxide, and lead. States are required to adopt standards that are at least as stringent as the NAAQS. The Arizona ambient air quality standards are identical to the NAAQS. The NAAQS and Arizona standards are presented Table 3-29.

TABLE 3-29 AMBIENT AIR QUALITY STANDARDS			
Pollutant	Averaging Time	Federal/Arizona^a: µg/m³ (ppm)[*]	
		Primary	Secondary
Carbon Monoxide	1 hour 8 hours	40 (35) ^b 10 (9)	no standard no standard
Nitrogen Dioxide	annual	100 (0.053)	100 (0.053)
Ozone	1 hour	235 (0.12)	235 (0.12)
PM ₁₀	24 hour annual	150 50 ^c	150 50 ^c
Sulfur Dioxide	3 hours 24 hours annual	no standard 365 (0.14) 80 (0.03)	1300 (0.50) no standard no standard

* µg/m³ stands for “micrograms per cubic meter”
ppm stands for “parts per million”

a Federal and Arizona standards are not to be exceeded more than once per year except in the case of the PM₁₀ and ozone standards. Compliance is determined by the number of days the PM₁₀ and ozone standards are exceeded. The number of exceedance days per year, based on a 3-year running average, is not to exceed 1.

b Carbon monoxide is measured in mg/m³ - milligrams per cubic meter.

c Annual arithmetic mean.

Sources: 40 CFR, Part 50; Arizona Administrative Code, Title 18, Article 2

The federal Clean Air Act requires that states classify air basins (or portions thereof) as either “attainment” or “non-attainment” with respect to the criteria pollutants. If an air basin does not meet the NAAQS for one or more pollutants, the area is classified as “non-attainment” for that pollutant. For these areas, states are required to formulate and submit State Implementation Plans (SIPs) to the EPA that outline those measures the state will use 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 3-30 and described in Table 3-30. For PM₁₀, all those areas designated non-attainment were classified as “moderate” at the time of the designation; reclassification to “serious” may occur if the standards can not be attained.

TABLE 3-30 FEDERAL AND STATE NON-ATTAINMENT AREAS		
Area	Pollutant	Classification
Ajo	sulfur dioxide	does not meet primary standards
	TSP [*]	does not meet primary standards
	PM ₁₀	moderate
Yuma	PM ₁₀	moderate
* TSP is total suspended particulate matter		
Source: 40 CFR Part 81		

To preserve those areas that have air of better quality than the NAAQS, the Clean Air Act established the Prevention of Significant Deterioration (PSD) Program. The PSD regulations divide the attainment areas into three areas of air quality. Class I areas, such as national parks and some wilderness areas, have pristine air and almost no increases in air pollution are allowed. Class II areas allow moderate development, and Class III areas allow extensive development. There are no designated Class I areas within the study area.

3.16.4 Existing Air Quality

To characterize the air quality in the study area, Table 3-31 presents monitored air pollutant concentration data collected during 1995 and 1996 at four locations near the study area. Additional data for 1985 has been included to illustrate improvements in the ambient PM₁₀ levels that have occurred since that time. Also, the most recent data available for levels of sulfur dioxide at Ajo, Arizona was collected in 1985. With the exception of PM₁₀, 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 and PM₁₀ approach the NAAQS in the vicinity of the study area. Table 3-31 also includes percent of NAAQS values for each of the criteria pollutants. The percentages represent the ratio of the average of the observed values during 1995 and 1996 for each pollutant (except sulfur dioxide which used the 1985 data) and the referenced standard. The air quality over most of the study area may be considered good to excellent.

FIGURE 3-30
NON-ATTAINMENT AREAS IN THE BMGR VICINITY
11 x 8 ½ B&W

**TABLE 3-31
AIR QUALITY SUMMARY: BMGR AIRSPACE REGION
1985, 1995, 1996**

		Yuma	Ajo	Casa Grande	Tucson (4591 N. Pomona)
carbon monoxide (8-Hr Max)	1996	*	*	1.2 ppm	2.7 ppm
	1995	*	*	1.1 ppm	3.8 ppm
	1985	5 ppm	*	*	*
nitrogen dioxide (Annual Avg.)	1996	*	*	*	36 µg/m ³
	1995	*	*	*	38 µg/m ³
	1985	*	*	*	*
Ozone (1-Hr Max)	1996	0.10 ppm	*	0.10 ppm	0.09 ppm
	1995	0.11 ppm	*	0.08 ppm	0.10 ppm
	1985	0.11 ppm	*	*	*
PM ₁₀ (Annual Avg.)	1996	37 µg/m ³	21 µg/m ³	30 µg/m ³	*
	1995	35 µg/m ³	24 µg/m ³	29 µg/m ³	*
	1985	63 µg/m ³	41 µg/m ³		*
sulfur dioxide (Annual Avg.)	1996	*	*	*	*
	1995	*	*	*	*
	1985	*	40 µg/m ³	*	*
Relation of Area Concentrations to the NAAQS					
Pollutant	Average Time		NAAQS	Percent NAAQS	
carbon monoxide	8-hour		9 ppm	24	
nitrogen dioxide	Annual average		100 µg/m ³	37	
ozone	1-hour		0.12 ppm	80	
PM ₁₀	Annual average		50 µg/m ³	59	
sulfur dioxide	Annual average		80 µg/m ³	50	
ppm = parts per million					
µg/m ³ = micrograms per cubic meter					
* = no available data					
Source: Arizona Department of Environmental Quality 1997, 1996, 1986					

Particulate Matter

The PM₁₀ regulation was established by the Clean Air Act for particulates less than or equal to 10 microns in size. Sources of PM₁₀ include:

- # stationary point sources, such as fuel combustion and industrial processes
- # fugitive sources, such as roadway dust from paved and unpaved roads
- # wind erosion from open land

transportation sources, such as automobiles

Recently, the EPA proposed new standards for particulate matter. The EPA proposed revisions to the PM₁₀ standard with the addition of standards for particles less than 2.5 microns in size (PM_{2.5}) and plans to revise the method for the determining when an area exceeds the standard. Promulgation of the standard occurred on 18 July 1997.

PM₁₀ is monitored at three of the four locations illustrated in Figure 3-29. None of the annual averages at these locations have exceeded the annual standard. Two locations in the study area—Yuma and Ajo—have had decreasing PM₁₀ levels of nearly 50 percent during the last 10 years.

Ozone

Ozone is not emitted directly into the atmosphere, but rather is produced through a photochemical reaction involving hydrocarbons and nitrogen oxides, known as precursors. Because ozone formation results from the mixing of precursors, ozone is more of a regional concern than that associated with more localized sources of pollution such as PM₁₀. The primary sources of ozone precursors are 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, Casa Grande, and Tucson during 1995 and 1996 are near the standard. All areas within the study area are designated as “attainment” for the NAAQS for ozone. On 18 July 1997, the EPA promulgated new ozone levels for the future NAAQS. For ozone, attainment of the standard will be based on 8-hour averages rather than on 1-hour averages. The level of the standard will be lowered from the present 0.12 ppm to 0.08 ppm, and the method for the determination of exceedances will be revised.

Carbon Monoxide

Carbon monoxide is an odorless, invisible gas usually formed as the result of incomplete combustion of organic substances. The primary source of carbon monoxide is motor vehicles. Secondary sources include aircraft emissions, and agricultural and/or forest burning. Like particulates, 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 are more frequent.

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. All areas within the study area are designated as “attainment” for the NAAQS established for carbon monoxide.

Sulfur Dioxide

Sulfur dioxide is formed during the combustion of sulfur bearing materials, such as sulfur ores or fossil fuels. Sources that emit large quantities of sulfur, such as copper smelters, contribute to ambient concentrations of sulfur dioxide. Of the air quality data reviewed in the study area, sulfur dioxide data is the most incomplete. During 1985, the major emitter of sulfur was a smelter in Ajo, Arizona. The smelter contributed almost 50 percent of the NAAQS for sulfur dioxide. After 1985, 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, although no monitoring stations exist near the study area. Levels of nitrogen dioxide obtained at the closest monitoring station at 4591 North Pomona Avenue in North Tucson were well below the respective standard. All areas within the study area are designated as “attainment” for the NAAQS established for nitrogen dioxide.

Lead

The main sources of lead emissions are from vehicles fueled with leaded gasoline operating in the study area and/or lead smelters. Because no lead smelters and very few vehicles using leaded fuel operate in the study area, levels of lead can be expected to be well below the NAAQS. Data on lead emissions are not collected at the monitoring stations near the study area.

3.17 BIOLOGICAL RESOURCES

Military withdrawal of the BMGR has allowed the natural processes of the Sonoran Desert, not the activities of humans, to dominate the ecological landscape of the range. Although military activities have occurred on the range over the last 57 years, less than two percent of the BMGR has experienced moderate to high levels of disturbance to soil surfaces or vegetation communities resulting from these activities. This has occurred because the military aviation training conducted on the BMGR requires a large land area to protect public safety, but only a small portion of the area must be disturbed to support that training. Safety concerns require that economic activities such as mining, livestock grazing, or agricultural development be excluded. Other public land uses such as recreation can occur to some degree, but must be restricted from high hazard areas. These exclusions and restrictions have further protected resources on the BMGR.

3.17.1 Vegetation

Vegetation of the BMGR is characterized by the Lower Colorado River Valley Subdivision and the Arizona Upland Subdivision (Brown 1973; Brown and Lowe 1974; Lowe 1964; Shreve and Wiggins 1964; Turner and Brown 1982) of Sonoran Desertscrub (Turner and Brown 1982). Most of the BMGR, particularly the western and northern portions, is within the Lower Colorado River Valley Subdivision. The south and southeastern portions are mostly within the Arizona Upland Subdivision (U.S. DoD, MCAS Yuma 1997). A list of plant species that may occur on the BMGR, including the Cabeza Prieta NWR, is provided in Appendix E, Table E-1 along with both the common and scientific names. Only common names are provided in the text.

Within the Lower Colorado River Valley Subdivision are several plant communities distinguished by characteristic dominant species. The most widespread plant community on the BMGR is dominated by two plant species: creosote bush and white bursage. Reichenbacher and Duncan (1989) estimate that the creosote bush-white bursage association occupies about three-fourths of the non-mountainous terrain of the BMGR.

Creosote bush occurs as the single, dominant plant species over large parts of the range, especially in the intermountain, alluvial valleys and plains along the northern edge of the range where soils have high proportions of silt and clay (Marks 1950 *in* Reichenbacher and Duncan 1989). Where soils are more sandy to gravelly, creosote bush is commonly associated with white bursage. In local situations, white bursage may be dominant. Other perennial species within the shrub layer that commonly occur in creosote bush-white bursage associations include little-leaved ratany, white ratany, Anderson thornbush, silver cholla, diamond cholla, devil's cholla, and pencil cholla. Tree or tree-like species that may occur with creosote-bursage include blue palo verde and ironwood (U.S. DoD, MCAS Yuma 1997).

An association of white bursage-big galleta grass-Mormon tea is largely confined to the Mohawk Dunes on the west side of the Mohawk Mountains. Elements of this association are also present on less-developed dune systems throughout the BMGR, including the northern extension of the Gran Desierto. Away from the Mohawk Dunes, creosote bush tends to replace Mormon tea. Other species that may occur on the Mohawk Dune system are Schott's wire lettuce, creosote bush, Spanish needles, dune indigo, desert dicoria, crucifixion thorn, and three-awn (U.S. DoD, MCAS Yuma 1997).

Ephemeral watercourses that traverse intermontane valleys support unique plant associations. Representative species include blue paloverde, desert lavender, catclaw, ironwood, wolfberry, and locally, smoke tree and desert willow.

Saltbush series are also characteristic of the Lower Colorado River Valley Subdivision. Saltbush series occupy sites with very fine soils that have a higher capacity for water retention and are more alkaline than soils occupied by creosote bush. Much of the land in the vicinity of the BMGR that has been converted to agricultural use formerly supported large expanses of saltbush. On the eastern BMGR, this series is quite limited and is not present over any large expanses of land (Dames & Moore 1996).

The Arizona Upland Subdivision of the Sonoran Desert is found on the southern and southeastern portions of the range, including the Cabeza Prieta NWR. This subdivision is present on rocky bajadas,

foothills, and mountain slopes; and is best developed on the BMGR east of State Route 85. This subdivision is represented by saguaro, foothill paloverde, ocotillo, and a wide array of other cacti and shrubs (Dames & Moore 1996).

A large number of plant associations are characteristic of this subdivision, present locally in response to soil conditions, slope exposure, and average annual rainfall. On the BMGR, the triangle-leaf bursage-foothill paloverde and triangle-leaf bursage-saguaro-mixed scrub association are most common. These two associations are dominant over much of the Sand Tank and Saucedá mountain ranges. Interspersed are various associations of brittlebush, jojoba, creosote bush, canotia, and ironwood (Dames & Moore 1996).

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 Saucedá 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).

On the extreme eastern and northeastern 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. Genera of grasses in this portion of the range include at least five species of *Aristida*, four species of *Bouteloua*, three species of *Leptochloa*, two species each of *Muhlenbergia* and *Tridens*, as well as species of *Bothriochloa*, *Bromus*, *Cynodon*, *Digitaria*, *Elymus*, *Enneapogon*, *Eragrostis*, *Heteropogon*, *Hilaria*, *Panicum*, *Phalaris*, *Schismus*, *Setaria*, and *Vulpia* (Dames & Moore 1996).

Fire has not been an important factor in the evolution or composition of vegetative communities 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 (US DOI, BLM 1990). 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 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 on the BMGR, 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 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.

Potential causes of fire on the BMGR include lightning strike, 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. These fires have not exceeded one or two acres. 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.

3.17.2 Wetlands and Floodplains

Wetlands and floodplains data were collected as required by land withdrawal regulations [43 CFR 2310.3-2(b)(4)], the Clean Water Act, and NEPA (Geraghty & Miller and SWCA 1996). Affected wetland areas are defined as those subject to direct effects from ordnance delivery, road construction and use, or similar actions, as well as those that could be affected indirectly by erosion and increased sedimentation (U.S. Department of Defense 1994).

Geraghty & Miller (1997) identified 206 aquatic sites on the BMGR, including the Cabeza Prieta NWR. Aquatic sites were classified into 12 categories: (1) artificial catchments, (2) springs, (3) ephemeral water falls, (4) reservoirs, (5) playa lakes, (6) charcos, (7) modified tinajas, (8) natural tinajas, (9) wells, (10) sewage disposal ponds, (11) National Wetland Inventory palustrine wetlands, and (12) National Wetland Inventory riverine wetlands. These sites are scattered across the range, but are mostly at the bases of mountains, and on the eastern range. Most are man-made structures developed for wildlife. Only 19 sites can be classified as wetlands as defined by Executive Order 11990 or the Clean Water Act (Geraghty & Miller 1997). There are no perennial rivers or streams on the BMGR. Ephemeral washes may flow after summer thunderstorms and winter rains.

3.17.3 Wildlife Habitat

Wildlife habitats on the BMGR are generally synonymous with vegetative communities. However, not all wildlife species occur uniformly throughout any given vegetation type. General habitats that are of particular importance to wildlife species within the BMGR have been divided into lowland habitats, microphyll woodlands, upland habitats, sand dunes, and open water. Most of the Cabeza Prieta NWR is included in the range, though only the airspace is used for military operations. Representative species of birds, reptiles and amphibians, and mammals that may occur on the BMGR and their preferred habitat type are listed in Appendix E, Tables E-2, E-3, and E-4.

Lowland Habitats

Lowland habitats are areas below the basal contour of mountain ranges and associated foothills and rocky outcrops not including major drainages (i.e., microphyll woodlands). Lowland areas are floristically characterized by associations of creosote bush and white bursage. Commonly associated plant species include little-leaved ratany, cholla, thornbush, brittlebush, ocotillo, ironwood, paloverde, and saguaro (U.S. DoD, MCAS Yuma 1997).

Wildlife species generally respond to changes in vegetative cover and soil conditions within lowland habitats. Rodent species density and diversity are relatively high in creosote bush scrub and usually decrease in sparse cover. Creosote bush habitats with deep soils are characterized by many burrows at the base of plants. These areas contain fossorial (burrowing) species including pocket mice, kangaroo rats, kit fox, badger, and many species of reptiles. Soil substrate is an important limiting factor in the distribution and density of fossorial mammals and reptiles. Burrowing species require friable soils and their density and diversity characteristically decline in rockier habitats (U.S. DoD, MCAS Yuma 1997). Creosote bush habitats are notably lacking in birds (Turner and Brown 1982), although black-throated sparrows and lesser nighthawks breed in these habitats on the BMGR (Gilbert 1996).

Microphyll Woodlands

Microphyll woodlands on the BMGR are associated with ephemeral drainages. This habitat type occurs along the edges of large washes (e.g., Fortuna Wash and Coyote Wash). Generally, the vegetation consists of taller trees and shrubs including blue paloverde, ironwood, and smoke tree. Blue paloverde and ironwood are found along nearly the entire length of most washes, including minor ones. Western honey mesquite occurs intermittently and smoke tree is more common in fine-grained sandy wash soils at lower elevations (U.S. DoD, MCAS Yuma 1997). Other common species include chuperosa, burro bush, parish viquiera, and big galleta (Reichenbacher and Duncan 1989).

From the standpoint of wildlife diversity, microphyll woodlands probably support the most species on the BMGR by providing abundant food, cover, and relatively more water for wildlife than any other habitat type. This habitat type supports more nesting bird species than any other on the BMGR and represents a significant 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. Some mammalian species, such as desert mule deer, depend on these woodlands for foraging, shade, movement corridors, and cover for critical life history events such as fawning. Various 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 woodlands. Many reptile species occur in microphyll woodlands where forage (insects, fruits, green plants, and lizards) is plentiful (U.S. DoD, MCAS Yuma 1997).

Upland Habitats

Upland areas are 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 and southeastern portions of the BMGR including the Cabeza Prieta NWR, upland habitats support a vegetation type that is more characteristic of the Arizona Upland Subdivision, but still largely ecotonal 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. DoD, MCAS Yuma 1997).

Wildlife in these upland habitats include mountain lion, coyote, black-tailed jack rabbit, desert tortoise, and various species of lizards and snakes. Caves, crevices, and abandoned mine shafts in this habitat type provide roosting and nursery colony sites for several species of bats. Uplands in Arizona are also important for desert bighorn sheep (U.S. DoD, MCAS Yuma 1997).

Sand Dunes

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. DoD, MCAS Yuma 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, heteromyid (pocket mice and kangaroo rats) rodents that are highly adapted to life in the absence of free water. Other mammals that are likely to be found in or near dune systems include rabbits and hares, ground squirrels, wood rat, grasshopper mouse, coyote, Sonoran pronghorn, and kit fox (U.S. DoD, MCAS Yuma 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 lark, loggerhead shrike, LeConte's thrasher, mockingbird, black-tailed gnatcatcher, and black-throated sparrow. Reptile species likely to be present include leopard lizard, flat-tailed horned lizard, Colorado Desert 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 Colorado Desert fringe-toed lizard is limited to dune habitats (U.S. DoD, MCAS Yuma 1997).

Open Water

Wildlife that may use open water on the range include bighorn sheep, deer, coyote, pronghorn, javelina; migrant shorebirds and waterfowl; and various other species. Open waters are extremely important to toads for egg-laying and larval development (University of Arizona School of Renewable Natural Resources [UASRNR] 1986). Water sources on the range include springs, tinajas, ephemeral washes, and human-developed waters.

There are no perennial streams on the BMGR. The nearest perennial stream is the Gila River near the northern boundary of the range (EIP Associates 1990). There are several natural springs on the range. Agua Dulce Spring in the southeast corner of Cabeza Prieta NWR and Dripping Spring in the Gila Mountains are perennial, and Bender Spring may be as well. There are numerous natural tanks (tinajas) that hold water for extended periods (UASRNR 1986).

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. Concern for water availability to wildlife has resulted in many human-developed waters, including drainage dams, catchments, and improvements or expansions of natural tanks. These developed waters are monitored and maintained by the AGFD for the benefit of wildlife. Of particular concern is the provision of reliable waters for desert bighorn sheep. Although the importance of water availability to Sonoran pronghorn is unknown, pronghorn frequent water sources on the eastern part of the range (Hervert et al. 1995; Hughes 1991). Water sources on the western segment of the range, however, are not known to be frequented by Sonoran pronghorn (U.S. DoD, MCAS Yuma 1997).

Ephemeral water sources, including tinajas and sand tanks, are also important to wildlife populations. Tinajas are natural cavities or depressions, usually in exposed bedrock, that fill periodically as a result of runoff from storm events. They are usually located in stream channels and can range in size from a few inches deep to more than 20 feet across and more than 40 feet deep. Some tinajas, such as Borrego Tank in the Tinajas Altas Mountains, have been improved to help assure a longer lasting, larger quantity of water. At Tinajas Altas Tanks, small steps have been constructed at two of seven natural rock tinajas to ensure that wildlife can escape during low water levels.

3.17.4 General Wildlife

This section describes the general wildlife found in various habitats on the range. Appendix E includes lists of wildlife species and their habitat preferences for birds (Table E-2), reptiles and amphibians (Table E-3), and mammals (Table E-4).

Large Mammals

Desert Mule Deer

Mule deer are found throughout Arizona, except in the southwest corner of the state (Hoffmeister 1986). Desert mule deer occupy mountains, hills, and desert washes, and are reliant on perennial water. The BMGR is considered marginal habitat for mule deer, although they are more common than white-tailed deer (AGFD 1985). In southwestern Arizona desert mule deer are not migratory and have reported home range areas of 121 square kilometers for does (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 have adapted 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 (BLM 1990). 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 have been recently documented on the western edge of the Cabeza Prieta NWR (Spiller 1994).

White-tailed Deer

In Arizona, white-tailed deer occur through 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 (Hoffmeister 1986). White-tails are found on the far eastern edge of the BMGR (BLM 1990) and are known from the Saucedo, Sand Tank, Growler, and Ajo mountains (Hoffmeister 1986).

Desert Bighorn Sheep

Desert bighorn sheep occupy essentially all upland habitat within the BMGR (BLM 1990). On rare occasions bighorn sheep utilize lowland habitats, especially when moving from one mountain range to another. Bighorn have been reported to occasionally cross between mountain ranges on the Cabeza Prieta. 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 forbes, grasses, and shrubs, which are also preferred by burros (BLM 1990). 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 1 to 15 individuals with a mean group size of 3. Except during the reproductive period, groups tend to be segregated in

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 escape predators.

Collared Peccary

The collared peccary's (also known as javelina) range 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 collared peccaries 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. Their preferred food is cacti, especially prickly pear. Peccaries typically form stable herds of variable sizes. Predators of peccaries include coyotes, bobcats, and mountain lion (Hoffmeister 1986). Collared peccary are known to occur in the eastern portion of the BMGR (UASRNR 1986; Hoffmeister 1986) and are commonly observed in the Saucedo and Sand Tank mountains. The westernmost reported occurrence of the species on the range by Hoffmeister (1986) was at Tule Well on the Cabeza Prieta NWR; however, several collared peccaries have been sighted in the vicinity of the Tinajas Altas Mountains by Border Patrol and AGFD personnel (Gilbert 1994).

Feral Burros

The Wild Horse and Burro Act (P.L. 92-195) was passed by U.S. Congress in 1971 to protect burros. Burros are abundant in many places in Arizona, especially in many of the desert ranges along and near the Lower Colorado River (Hoffmeister 1986). In the southwestern United States they were brought by the Spanish in the sixteenth century. This species was domesticated over 6,000 years ago (Nowak 1991). 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). A small transient population of burros (50 to 150 animals) has been observed on the eastern BMGR. The burros on the BMGR, claimed by members of the Tohono O'odham Nation, are trespassing animals but are not a self-sustaining population. 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 (Hoffmeister 1986).

Predators and Fur-Bearing Mammals

Predators present on the BMGR include mountain lion, kit fox, gray fox, coyote, bobcat and skunks. Mountain lions are found primarily in rugged terrain on the eastern BMGR (UASRNR

1986). Kit foxes are present on valley bottoms where they dig dens in friable soils and prey on kangaroo rats, pocket mice and other rodents, and rabbits. Gray foxes and bobcats occur along major washes and in rocky uplands where they prey on a variety of small mammals, birds, and reptiles. Coyotes are wide ranging and may be encountered in almost any habitat, but they are generally less common in rocky uplands.

Mammals classified as fur-bearers by the AGFD (1993) include bobcat, badger, and ringtail. 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 (BLM 1998). This species' primary distribution in Arizona is in the southeastern and central parts of the state. At lower elevations (e.g., desert areas), 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. DoD, MCAS Yuma 1997).

Small Mammals

Small mammals on the range include jack rabbits, cottontails, and many species of bats and rodents. Bat species observed on the BMGR include California leaf-nosed bat, southwestern cave myotis, western pipistrelle, California myotis, pallid bat, lesser long-nosed bat, and big brown bat (Dames & Moore 1996). 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 rat, and grasshopper mouse.

Birds

Avifauna of the Goldwater Range (Appendix E, Table E-2), including the Cabeza Prieta NWR, 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 creosote bush (Dames & Moore 1996).

Creosote bush 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 creosote associations. Several species of migratory, wintering birds (including horned larks and sage sparrows) are associated with creosote bush vegetation.

Reptiles and Amphibians

The herpetofauna of the BMGR, including the Cabeza Prieta NWR, consists of 6 amphibians and 44 reptiles (Appendix E, Table E-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.

The reptiles of the BMGR, including the Cabeza Prieta NWR, consist of 1 tortoise, 20 lizards (including Gila monster), and 23 species of snakes (Appendix E, Table E-3). This assemblage of species is characteristic of Sonoran Desert habitats. Many have their population centers in the arid Southwest (e.g., Sonoran 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).

3.17.5 Special Status Species

Overview

Special status species are species of plants or animals that, because of their scarcity or documented declining population numbers in the state or nation, have been placed on lists of endangered, threatened, proposed, or otherwise sensitive species. The USFWS lists special status species by several categories, including endangered, threatened, proposed endangered or threatened, and candidate. The classification system for species with federal status is as follows:

- # **Endangered (E):** Species identified by the USFWS under the Endangered Species Act (1973) as being in danger of extinction throughout all or a significant portion of its range.
- #
- # **Threatened (T):** Species identified by the USFWS under the Endangered Species Act (1973) which are likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.
- # **Proposed (PT, PE):** Species being reviewed by USFWS that have been proposed for listing as a threatened or endangered species.
- # **Candidate (C):** Species for which USFWS has sufficient information on biological vulnerability and threats to support proposals to list them as endangered or threatened.

The State of Arizona also maintains lists of sensitive plants and animals. AGFD lists animal species under one category:

- # **Wildlife of Special Concern in Arizona (WSC)** (in preparation): Species whose occurrence in Arizona is or may be in jeopardy, or with known or perceived threats or population declines. Species included are currently the same as those listed in

“Threatened Native Wildlife in Arizona (1988).”

The Arizona Native Plant Law (1993) identifies plants belonging to the following categories:

- # **Highly Safeguarded (HS):** Those Arizona native plants whose prospects for survival in the state are in jeopardy or are in danger of extinction, or are likely to become so in the foreseeable future.
- # **Salvage Restricted (SR):** Those Arizona native plants not included in the Highly Safeguarded category, but that have a high potential for theft or vandalism.

Special status species that may occur on the BMGR were identified with input from the USFWS, AGFD, and Defenders of Wildlife (a nonprofit conservation organization). Four of the species identified have no designation other than being considered sensitive by the United States Forest Service (USFS) when occurring on lands managed by the USFS. These species include the greater western mastiff bat, Harris’ hawk, Gila monster, and California snakewood. Because the BMGR does not contain lands administered by the USFS, the Forest Service “sensitive” species are not discussed individually in this section, but are considered among other species in the general discussions of wildlife and vegetation in Sections 3.17.4 and 3.17.1, respectively. Table 3-32 lists the special status species identified by wildlife agencies, federal and/or state status, potential for presence of the species or its habitat, and brief habitat descriptions.

TABLE 3-32 SPECIAL STATUS SPECIES IDENTIFIED AS POTENTIALLY PRESENT ON THE BMGR						
Common Name <i>Scientific Name</i>	Federal Status	State Status	Species or Habitat			Habitat on Range
			present	potential	not expected	
Lesser long-nosed bat <i>Leptonycteris curasoae yerbabuena</i>	E	WSC	X			Cave or mine-nesting/ roosting summer resident, forages in desertscrub habitats.
California leaf-nosed bat <i>Macrotus californicus</i>	-----	WSC	X			Cave or mine-nesting/ roosting year-round resident, forages in desertscrub or microphyll woodlands.
Sonoran pronghorn <i>Antilocapra americana sonoriensis</i>	E	WSC	X			East of Gila and Tinajas Altas mountains
Bald eagle <i>Haliaeetus leucocephalus</i>	T	WSC			X	Aquatic habitat not found on the BMGR.
Peregrine falcon <i>Falco peregrinus anatum</i>	E	WSC	X			Isolated cliffs; winter migrant.

**TABLE 3-32
SPECIAL STATUS SPECIES IDENTIFIED AS
POTENTIALLY PRESENT ON THE BMGR**

Common Name <i>Scientific Name</i>	Federal Status	State Status	Species or Habitat			Habitat on Range
			present	potential	not expected	
Yuma clapper rail <i>Rallus longirostris yumanensis</i>	E	WSC			X	Marsh habitat not found on the BMGR.
Southwestern willow flycatcher <i>Empidonax trailii extimus</i>	E	WSC			X	Well-developed riparian areas with cottonwood, willow, or tamarisk are not present on the range.
Cactus ferruginous pygmy-owl <i>Glaucidium brasilianum cactorum</i>	E	WSC		X		Microphyll woodlands
Flat-tailed horned lizard <i>Phrynosoma mcalli</i>	----	WSC	X			West of Gila Mountains
Cowles fringe-toed lizard <i>Uma notata rufopunctata</i>	----	WSC	X			Aeolian sand dunes.
Desert tortoise <i>Gopherus agassizii</i>	----	WSC	X			Mountains east of San Cristobal Valley.
AcuZa cactus <i>Echinomastus erectocentrus acunensis</i>	C	HS	X			Only one confirmed individual observed on the range.
Sand food <i>Pholisma sonorae</i>	----	HS	X			Sand dunes in extreme southwestern range.
Blue sand lily <i>Tritelelopsis palmeri</i>	----	SR	X			Dunes at western base of Gila Mountains.
Kearney sumac <i>Rhus kearneyi</i>	----	SR	X			Dry cliffs of Tinajas Altas

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. Pursuant to this requirement the Air Force has recently prepared biological assessments to address the effects of the renewal of the BMGR on the lesser long-nosed bat, Sonoran pronghorn, and cactus ferruginous pygmy owl (Luke AFB 1997, USAF 1997). These assessments have been prepared for and submitted to the USFWS.

Mammals

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 (53 Federal Register 38456; September 30, 1988). This species is also included in Wildlife of Special Concern in Arizona by the AGFD.

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 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 while males occupy separate roosts. 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 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). Lesser long-nosed bats fly long distances (up to 75 miles) between roosting and feeding areas (Fleming 1993). During the day, they roost in mine tunnels and natural caves (Hayward and Cockrum 1971).

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). The most current status of long-nosed bats is provided by Cockrum and Petryszyn (1991) who concluded that current 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 outside of the Cabeza Prieta NWR despite a number of bat surveys (Dames & Moore 1997, Dalton and Dalton 1994, Cockrum and Petryszyn 1991). There is a maternity colony of lesser long-nosed bats in the Growler Mountains in the Cabeza Prieta NWR. The bats are also known from the Agua Dulce Mountains in the southeast corner of the Cabeza Prieta NWR (Cockrum and Petryszyn 1991).

Densities of agaves and columnar cacti are too low to provide a significant food source for the bats throughout most of the range (Luke AFB 1997). Saguaro densities are higher in the northeastern section of the range. A total of six light-tagged lesser long-nosed bats were observed in the northeastern section of the range in late May and early June of 1994 (Dalton et al. 1994).

California Leaf-nosed Bat

Status: The California leaf-nosed bat is included in Wildlife of Special Concern in Arizona by the AGFD.

Background Information: The California leaf-nosed bat is a year-round resident in desert scrub habitats (mostly Sonoran desert scrub) 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 desert scrub habitats due to the relatively mild climate and continuous availability of food. They feed primarily on large, night-flying beetles, grasshoppers, and moths. They also feed on insect larvae, especially of butterflies, which are taken from the bushes or on the ground. There is some evidence that they also feed on fruits, including 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. The Fortuna Mine area of the Gila Mountains and the Copper Mountains have been identified as particularly important areas for the California leaf-nosed bat. Some mines have been estimated to support as many as 300 individuals (Dalton and Dalton 1994; Dames & Moore 1996).

Sonoran Pronghorn

Status: The Sonoran pronghorn is federally listed as endangered (32 Federal Register 4001, March 11, 1967) without determination of critical habitat. This species is also included in Wildlife of Special Concern in Arizona by the AGFD. According to the USFWS (1994a), Sonoran pronghorn populations may have declined due to illegal hunting in Sonora, habitat degradation by livestock, and habitat loss from agricultural and other developments, particularly loss of riparian habitat along the Gila and Sonoyta rivers.

Background Information: The Sonoran pronghorn is one of five currently recognized subspecies of pronghorn. The description of this subspecies is based on a small number of specimens and its taxonomic status as a distinct subspecies has been questioned by Cockrum (1981). Research continues on the question of subspecific designation (Thompson-Olais 1994). This subspecies is currently recognized by both the USFWS and AGFD (U.S. DoD, MCAS Yuma 1997).

The present distribution of Sonoran pronghorn is south of the Gila River, east of the Copper and Cabeza Prieta mountains, west of State Route 85, and extending south into Sonora Mexico to about Caborca (USFWS 1994a; Wright and deVos 1986). This area encompasses portions of the BMGR, including the Cabeza Prieta NWR (Figure 3-31). The present distribution of the Sonoran pronghorn is considered to be greatly reduced from the historic distribution (Wright and deVos

1986). The historic range of the pronghorn spreads west to the Imperial Valley in California (Wright and deVos 1986).

Based on aerial surveys for Sonoran pronghorn conducted between 1992 and 1994 the population estimate for the United States was between 125 and 251 animals, and the Mexican population is estimated at between 179 and 313 animals (Snow 1994). A more recent aerial survey conducted in December 1996 suggests that population numbers in the United States are between 130 and 160 individuals (USFWS 1997).

Group sizes of Sonoran pronghorn are smaller than those reported for northern populations of other pronghorns species. Hughes (1991) reported a mean group size of 2.5 animals for his two years of observations. Wright and deVos (1986) reported a mean group size of 5.1 with the largest group numbering 21 pronghorn. Sonoran pronghorn appear to have larger home ranges than northern populations. Home range size estimates reported by Wright and deVos (1986) ranged from 15.6 to 468.6 square miles. Larger home ranges may be necessary to obtain enough forage in sparsely vegetated areas. The diet of the Sonoran pronghorn includes fruits from jumping cholla; annual herbaceous species such as Indian wheat and filaree; and a variety of shrubs, trees, and grasses (Carr 1970; Hughes and Smith 1990; Monson 1968).

The peak of breeding activity is in July (AGFD 1981). Most young are born in early March (AGFD 1981; Yoakum 1980). Like other pronghorn, the Sonoran subspecies usually seeks solitude during delivery (Hervert 1995). During the first week after birth, fawns are inactive, although at about five days of age they are able to outrun a man (U.S. DoD, MCAS Yuma 1997). Fawns eat vegetation by three weeks and by three months have pelage like an adult (Yoakum 1978).

Potential mortality factors for Sonoran pronghorn include predation, disease, drought, and human related factors such as poaching. Potential predators include coyotes, bobcats, mountain lion, and golden eagles (U.S. DoD, MCAS Yuma 1997). Coyotes are probably the major predator on Sonoran pronghorn (Phelps 1981).

Populations in Study Area: The estimated range of the Sonoran pronghorn in the United States is shown in Figure 3-31. The microphyll woodlands, an important component of pronghorn habitat during the summer months, are better developed in the southeastern portion of the BMGR. Research indicates that pronghorn will utilize dryer creosote bush scrub lowlands in the spring and fall months when forage is available. They move south and east into the uplands in the dryer season seeking thermal cover and forage within the microphyll wash habitats (deVos 1990). Wright and deVos (1986) found that creosote bush/ocotillo and paloverde/ironwood plant associations were preferred from late winter through summer, with does using these associations for fawning. These associations are found in the upper bajadas. The area between the Mohawk and Copper mountains north of the Cabeza Prieta NWR is known to be used by pronghorn (Hervert 1995; USFWS 1995), and is an area of concern to AGFD (Werner 1993). From the Copper and Cabeza Prieta mountains east to Arizona State Route 85, Sonoran pronghorn habitat includes all areas except for mountainous slopes.

Within the Cabeza Prieta NWR pronghorn use is widespread, but the Growler Valley, San Cristobal Valley, and Las Playas areas seem to be the areas of greatest use. While there are pronghorn outside the refuge, the Cabeza Prieta NWR is apparently where most observations are recorded. Records from radio-telemetry studies show heavy use in the southeast portion of the refuge (the Growler Valley from the Antelope Hills to the Bates Mountains), but this is biased by the area of capture for those animals studied. These records show use of both plains and uplands,

FIGURE 3-31
RANGE OF SONORAN PRONGHORN AND
FLAT-TAILED HORNED LIZARD,
GOLDWATER RANGE
11 x 17 B&W

with little use of the steep rocky mountains. Within the refuge, only rugged mountain terrain would be considered unsuitable habitat. East of Cabeza Prieta NWR, Sonoran pronghorn occupy the western half of Organ Pipe Cactus National Monument east to State Route 85.

Although the importance of water availability is not known (Geraghty & Miller and SWCA 1996), Sonoran pronghorn that frequent water sources may be subject to increased predation (USFWS 1994a).

Birds

Bald Eagle

Status: The bald eagle is federally listed as threatened (60 Federal Register 6000, July 12, 1995) without determination of critical habitat. This species is also included among Wildlife of Special Concern in Arizona by the AGFD.

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; USFWS 1987). 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 1988). 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 et al. 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 et al. 1991). Important food items in the Southwest include fish, waterfowl, rabbits, and carrion (USFWS 1987). Food availability and perch sites may limit wintering bald eagle abundance in Arizona (Newton 1979 *in* Busch 1988). Other factors potentially limiting abundance include human disturbances, and loss of aquatic habitat (Busch 1988; USFWS 1987).

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.

Peregrine Falcon

Status: The peregrine falcon is federally listed as endangered (35 Federal Register 16047, October 13, 1970; 35 Federal Register 8495, June 2, 1970) without determination of critical habitat. It is included among Wildlife of Special Concern in Arizona by the AGFD.

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 [AOU] 1983). Peregrines occur on isolated cliff ledges throughout Arizona, but in small numbers (Monson and Phillips 1981). Rosenberg et al. (1991) described 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; USFWS 1987). 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, riverbottoms, marshes, and lakes, which attract abundant bird life (USFWS 1987).

Falcons are usually on the nesting cliff by mid-March. The clutch size varies, but three to four eggs are usually laid in early April. Both sexes will incubate the eggs, but the male provides most of the prey. The incubation period is 33 days and after fledging, which usually takes place in mid-June to mid-July, the young remain in the natal area for several weeks before dispersing (USFWS 1987).

The primary reason for the decline of this species is reproductive failure due to pesticide contamination (USFWS 1987). Nationwide population declines in the 1950s and 1960s appear to have been reversed in recent years (AGFD 1988).

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 (BLM 1998).

Yuma Clapper Rail

Status: The Yuma clapper rail is federally listed as endangered (32 Federal Register 4001, March 11, 1967; 48 Federal Register 34182, July 27, 1983) without determination of critical habitat. In addition, it is included among Wildlife of Special Concern in Arizona by the AGFD.

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 et al. 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 et al. 1991; USFWS 1987). 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 (Eddleman 1989 *in* Rosenberg et al. 1991). The primary reasons for the Yuma clapper rail's decline are habitat destruction due to stream channelization and drying and flooding of marshes (USFWS 1992).

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, February 27, 1995) with critical habitat (62 Federal Register 39129, July 22, 1997). It is also included among Wildlife of Special Concern in Arizona by the AGFD.

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 (60 Federal Register 10694, February 27, 1995). 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. Therefore, the range does not provide habitat for breeding southwestern willow flycatchers. Flycatchers may occur on the range incidentally during migration.

Cactus Ferruginous Pygmy-owl

Status: The cactus ferruginous pygmy-owl is federally listed as endangered in Arizona without critical habitat designation (USFWS 1994b). The cactus ferruginous pygmy-owl is included among Wildlife of Special Concern in Arizona by the AGFD. 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 starlings for nesting cavities (AGFD 1996).

Background Information: 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 National Monument 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 in washes containing microphyll woodlands on the Organ Pipe Cactus National Monument. 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.

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.

Populations in Study Area: Based on the known distribution of this species in southwest Arizona, it is not expected to occur on the BMGR. There is one historical observation of the owl on the range, at Cabeza Prieta Tanks on the Cabeza Prieta NWR (Millsap and Johnson 1988). No owls have been detected during owl surveys conducted on the range between 1992 and 1996 (Collins and Corman 1995; Felley and Corman 1993; Reichenbacher and Taiz 1993; Tim Tibbits, unpublished data; UASRNR 1994, Dames & Moore 1996). Habitat characteristics for the species are present in microphyll woodlands on the range.

Reptiles

Flat-tailed Horned Lizard

Status: The flat-tailed horned lizard had been proposed for federal listing as threatened (USFWS 1993), but was withdrawn from proposed listing on 15 July 1996 because of some threats are considered less serious than originally thought, a further reduction of threats expected as a result of a conservation agreement, and data indicating population declines is inconclusive (USFWS 1997b). The conservative agreement is between federal and state agencies, including MCAS Yuma and implements the Flat-tailed Horned Lizard Rangelwide Management Strategy (Flat-tailed Horned Lizard Working Group of Interagency Coordinating Committee 1997) developed by the cooperating agencies. Part of the conservation strategy is the establishment of the Yuma Desert Flat-tailed Horned Lizard Management Area, which encompasses the westernmost portion of the BMGR. Management areas provide for land uses that are compatible with the conservation of the species and its habitat. This species is included among Wildlife of Special Concern in Arizona by AGFD.

Background Information: Like other horned lizards, this species has sharp spines around the back of its head that look like 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 et al. 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 et al. 1987), but are mostly absent from the main body of dunes (Rorabaugh et al. 1987). In Arizona, Rorabaugh et al. (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. Their diet consists almost entirely of ants, especially harvester ants (*Veromessor* and *Pogonomyrmex*) (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 105 NF, 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, off road vehicle activity, 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 (BLM 1990). Pesticide tolerances of flat-tailed horned lizard are not currently known (Johnson 1989). They have a definite predilection for thermoregulation on the paved roads leading to and from the various training areas on the BMGR (Dames & Moore 1992, unpublished data) and, like many other reptiles, are susceptible to road-kill (Johnson 1989).

Populations in Study Area: Flat-tailed horned lizards occur west of the Gila and Tinajas Altas mountains in the extreme western portion of the BMGR, as depicted in Figure 3-31 (Johnson and Spicer 1985; Rorabaugh et al. 1987). On the west side of the Gila Mountains, flat-tailed horned lizards and desert horned lizards are sympatric. To the east, the desert horned lizard is the only species found (Rorabaugh et al. 1987).

Cowles Fringe-toed Lizard

Status: The AGFD (1988) list does not recognize the subspecific *rufopunctata* designation, but lists the species among Wildlife of Special Concern in Arizona.

Background Information: The Cowles fringe-toed lizard, a subspecies of the Colorado fringe-toed lizard, is found in extreme southwestern Arizona and adjacent northwest Sonora, Mexico (Stebbins 1985) on the east side of the Colorado River. This species, and the subspecies, is restricted to fine, loose, wind-blown sand of dunes, flats, and washes (Stebbins 1985; AGFD 1988). It is found in sparsely vegetated creosote bush scrub and other scrub habitats. They feed primarily on insects, but occasionally on vegetation and other species of lizards (Stebbins 1985). The AGFD (1988) lists agricultural development, urbanization, and off-road vehicles as threats to the species.

Populations in Study Area: On the BMGR, this lizard is found in and adjacent to the Mohawk and Gran Desierto dunes (AGFD 1988). The BLM (1990) estimates these sandy dune areas to encompass about 75,000 acres.

Sonoran Desert Tortoise

Status: The AGFD includes the species among WSC in Arizona.

Background Information: The Sonoran population of the desert tortoise includes those 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 home range sizes of tortoises in upland habitats of the Picacho Mountains in Arizona ranged between 8 and 135 acres.

Populations in Study Area: Surveys conducted in the Sand Tank, Saucedo, and Aguila mountains, and the Crater Range of the eastern BMGR identified tortoise sign in all 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 mountains on the range (Dames & Moore 1996). Based on surveys conducted by the BLM (Goodman 1992), extremely low numbers of tortoises may occur in mountains west of the San Cristobol Valley. Some sign (one scat) was located in the Mohawk and Tinajas Altas mountains, and none in the Gila Mountains. Desert tortoise are also known to occur in the Growler Mountains within the Cabeza Prieta NWR.

Plants

AcuZa Cactus

Status: The acuZa cactus is a federal candidate and a Highly Safeguarded plant under the Arizona Native Plant Law (1993).

Background Information: The species distribution includes Arizona, and Sonora, Mexico (Heil and Melton 1994; Johnson 1992). AcuZa 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 acuZa 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 et al. 1982).

Populations in Study Area: There is an unconfirmed record of the cactus from the Sand Tank

Mountains outside the boundary of the BMGR (Benson 1969, 1982). A survey of 560 acres on the eastern portion of the BMGR located only one acuzacacti on the range (Geraghty & Miller and SWCA 1997). Two populations, ranging from about 23 to 33 mature and 6 to 17 immature cacti are present one-third mile south of the BMGR boundary. Cacti located by Geraghty & Miller and SWCA (1997) were found on pale pink-gray rhyolitic gravel and rock.

Sand Food

Status: The sand food is a Highly Safeguarded species under the Arizona Native Plant Law (1993).

Background Information: Previously known as *Ammobroma sonora*, sand food is a leafless, parasitic plant that attaches itself to the roots of such plants as white bursage, dune buckwheat, emory dalea, arrowweed, palmer coldenia, and plicate coldenia (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; however, the O'odham were able to locate the buried stem throughout the year. 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 (Dames & Moore 1997). These occur in the Gran Desierto in northwestern Sonora and the adjacent corners of Arizona, California and Baja California (WESTEC 1977 in Warren and Laurenzi 1987).

Populations in Study Area: Reichenbacher and Duncan (1989) indicate that this species does occur on sand dunes in the extreme southwestern corner of the BMGR, but believe it is unlikely that the species occurs as far north as the Mohawk Dunes. Several sand food plants were located on the range southwest of AUX-2 in May 1994 (Gilbert 1994).

Blue Sand Lily

Status: The blue sand lily is a Salvage Restricted plant under the Arizona Native Plant Law (1993).

Background: The blue sand lily is about 2 feet high with broadly lanceolate leaves. The species range includes the western base of the Gila Mountains and Baja California. It grows in dunes with *Hesperocallis* and *Oenothera* at an elevation of about 250 feet (Kearney and Peebles 1960).

Populations in Study Area: On the BMGR, the species has been observed in the dunes at

the western base of the Gila Mountains (Kearney and Peebles 1960), and at Pinta Sands on the Cabeza Prieta NWR. More than 100 individuals were observed in the Pinta Sands population in 1978 (AGFD Heritage Database). Blue sand lily is also found in foothills east of Yuma and on the east side of Telegraph Pass in the Gila Mountains. Although these two locations are not on the BMGR, the presence of similar habitat characteristics indicates potential habitat on the BMGR (Henry 1997).

Kearney Sumac

Status: The Kearney sumac is a Salvage Restricted plant under the Arizona Native Plant Law (1993).

Background: Kearney sumac is found in the Tinajas Altas and Gila mountains. It is found at an elevation of 1,000 to 1,500 feet in dry cliffs. This shrub has alternate leaves and small greenish, yellowish, or whitish flowers. It may reach a height of 18 feet. The fruit may be an important food for wildlife (Kearney and Peebles 1960).

Populations in Study Area: Kearney sumac is known from the dry cliffs of the Tinajas Altas and Gila mountains (Henry 1997).

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.⁴⁴

As stated by Mr. Leonard Richeson of the Office of the Assistant Deputy Under Secretary of Defense, “Environmental justice is a relatively new term. However, what it addresses should be familiar: the right of all Americans to be protected from adverse environmental impacts and to have a voice in the public participation process.”

3.18 ENVIRONMENTAL JUSTICE

3.18.1 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

Executive Order

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

⁴⁴ 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.

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.

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

4.0 ENVIRONMENTAL CONSEQUENCES OF ALTERNATIVES

4.1 INTRODUCTION

Environmental impacts are defined as modifications to the environment that are brought about by an outside action. Impacts can be beneficial or adverse. As defined in the glossary, impacts may also be described as direct or indirect. Impacts predicted as a consequence of the proposed action, alternative action, and no-action alternative are discussed in this chapter. The significance of impact is defined in terms of context and intensity (40 CFR 1508.27, see the glossary for a definition of significance).

The resources are addressed in the same order as they were presented in Chapter 3. Where appropriate, mitigation measures or management actions are identified to reduce or avoid potential impacts. Unavoidable adverse impacts; conflicts with land use plans, policies, and controls; energy requirements and conservation potential; the relationship between short-term use versus long-term productivity; and irreversible or irretrievable commitment of resources are also discussed in this chapter.

4.2 AIRSPACE AND RANGE OPERATIONS

4.2.1 Significance Criteria

Impacts to airspace and BMGR operations are considered significant if an action:

- # causes or perpetuates a condition within the National Airspace System that precludes or severely diminishes the right of one of the three major aviation user groups—general aviation, commercial air carriers, and DoD—to access airspace in the BMGR region.
- # diminishes or constrains the capabilities or capacity of the BMGR to meet the training needs of current regular or casual⁴⁶ military users
- # diminishes the flexibility of the BMGR to accommodate future training missions that may not yet be specifically defined or forecasted

4.2.2 Effects of the Proposed Action on Airspace

Renewal of the BMGR for an indefinite time period would have the positive effect of maintaining DoD access to needed training airspace. The renewal would neither preclude or diminish access by general aviation or commercial air carriers to airspace needed to support civil air transportation requirements.

Renewal of the BMGR land withdrawal would ensure that the overlying restricted airspace would also remain in effect. Restricted airspace is authorized to provide locations where activities that are hazardous to non-participating aircraft can be performed. Hazardous activities on the

⁴⁶ Regular military users include units from the BMGR region that routinely use the range. Casual users are other military units that use the range on an infrequent periodic or irregular basis.

BMGR include use of air-to-air cannon fire and missiles; air-to-ground bombs, rockets, missiles, and strafing fire; and surface-to-air missiles. In all of these events, ordnance, and/or ordnance and target debris strike the ground surface. Some of these training events involve munitions with live warheads that explode on impact. Such activities clearly present a potential hazard for surface users⁴⁷. The fundamental purpose of a weapons range land withdrawal, like the BMGR, is to reserve a land area corresponding to the overlying restricted airspace where ordnance impacts can occur safely because surface access by non-participants can be controlled as necessary.

As a result of the operational linkage between weapons range lands and restricted airspace, renewal of the BMGR indicates that continued retention of R-2301W, R-2301E, R-2304, and R-2305 would not be in question. Retention of this airspace would preserve DoD access to the restricted airspace needed to support the full spectrum of activities performed at the BMGR.

Renewal of the BMGR and retention of its restricted airspace would also be likely to support continued retention of the MTRs that terminate on the range, MOAs and associated ATCAAs in Arizona, and A-231. This effect would occur because of the pivotal importance of the BMGR to the units that use both the range and non-BMGR airspace in the region. For example, all student F-16 training for the Air Force and

⁴⁷ Examples of surface users participating in live-fire training on the BMGR include ground-based forward air controllers in designated safe observation posts that direct aircrew attacks on ground targets and range control officers and scoring personnel at manned ranges. Examples of nonparticipants include range EOD and maintenance personnel, natural resource managers, or public visitors.

ANG is flown in the BMGR region out of Luke AFB or the AZ ANG Base at Tucson. F-16 aircraft were flown on a combined total of 65,807 sorties during FY 1996 in BMGR airspace (R-2301E, R-3204, and R-2305), Sell 1 MOA/ATCAA, Sells Low MOA, Bagdad 1 MOA/ATCAA, Gladden 1 MOA/ATCAA, and Sunny MOA/ATCAA (these special use airspace areas are cited because use data by aircraft type are available for these areas). Almost 62 percent (40,781) of those sorties were flown within the BMGR. Of the F-16 sorties flown within the BMGR, 73 percent (29,830) involved either air-to-air or air-to-ground with munitions training and 17 percent (~6,800) used the GRMDS range. These data show that 36,630 F-16 sorties out of 65,807 in FY 1996, or 56 percent, were directly dependent on the live-fire or GRMDS capabilities of the BMGR. These training capabilities as well as many others are available within the local training region only at the BMGR. The missions at Luke AFB and Arizona ANG could not be continued as full spectrum cost effective training centers for F-16 aircraft (or for any other Air Force fighter or attack aircraft) without continued access to these BMGR capabilities. Without continued access, the ability to continue to support fighter or attack aircrew training missions out of Luke AFB and the Arizona ANG Base would be placed in serious jeopardy. Continuation of the A-10 aircrew training missions at Davis-Monthan AFB and the training missions at Silverbell Army Heliport (WAATS and the 1/285 AHB), and MCAS Yuma would face much the same level of uncertainty. The future of the non-BMGR training airspace used by these installations could in turn be placed in question. Thus, renewal of the BMGR would have the likely effect of solidifying the continuing need for non-BMGR training airspace in the region.

4.2.3 Effects of the Alternative Action on Airspace

The effects of a 25-year renewal of the BMGR with the option to request a follow-on range renewal on airspace cannot be differentiated from those foreseen for the proposed actionXa renewal for an indefinite time period. Either the proposed action or the alternative renewal action would presumably make the range available for continued military use until there is no longer a military need for the facility. The only distinguishing differences between these two alternatives are the implied length of the range withdrawal term and the administrative processes required for maintaining the withdrawal (periodic Congressional review under the proposed action) or securing further renewals (additional LEIS processes under the alternative renewal action). The foreseeable future for airspace is the same under either renewal alternative.

4.2.4 Effects of the No-action Alternative on Airspace

Non-renewal of the BMGR would significantly and adversely affect military access to the type and quality of airspace needed to support existing and foreseeable tactical aviation training in the BMGR region. Although a congressional decision to not renew the range land withdrawal would not affect airspace directly, expiration of the land component of the BMGR would radically alter its use. Non-renewal would require permanent suspension of all training involving live bombing, air-to-air or air-to-ground gunnery, rocketry, missile shoots, or other forms of surface impacting weapons

activity. The principal justification for the restricted airspace overlying the BMGR land withdrawal has been to provide separation between the hazards that live-fire training poses and nonparticipating aircraft. Permanent suspension of live-fire training would eliminate this justification and trigger a review of the continuing need for R-2301W, R-2301E, R-2304, and R-2305.

R-2301W and R-2301E also house advanced training involving up to 36 aircraft at a time in air combat tactics and maneuvers on the Marine Corps TACTS Range and the Air Force GRMDS. Although this training imposes severe limitations on the potential for participating and nonparticipating aircrews to see and avoid each other, it does not qualify as a hazardous activity under FAA policy on restricted airspace. This training alone would not justify continuation of restricted airspace.

Non-renewal of the BMGR and the loss of its overlying restricted airspace poses several possible outcomes affecting airspace. These include:

1. restructuring some or all of the BMGR airspace as MOAs and ATCAAs
2. restructuring other BMGR area MOAs and ATCAAs and/or moving the training missions performed within these airspaces
3. canceling some or all of the MTRs that terminate within the BMGR
4. canceling the restricted airspace overlying the BMGR
5. canceling some MOAs and ATCAAs elsewhere in the BMGR region

Several combinations of these five outcomes are possible and are discussed below. These

discussions are limited in scope, however, because this draft LEIS cannot reliably forecast the possibility of military mission changes, organization changes, or the propagation of new bases that might result with non-renewal of the BMGR. The inability to develop a plausible forecast of the mission changes associated with not renewing the BMGR at this time is directly related to the magnitude of assets and training programs that the DoD has invested in the BMGR environment.

A summary of the military air base structure and range developments that support training on the BMGR is presented in Chapters 1, 2, and 3. A measure of the importance of this investment is the fact that more than 500 tactical aircraft used for training on the range are permanently deployed in Arizona at five military air bases. Well over an additional 100 aircraft deploy to Davis-Monthan AFB each year under Operation Snowbird to train at the BMGR. Several hundred Navy and Marine Corps aircraft from between 50 to 70 squadrons deploy annually to MCAS Yuma for training on the BMGR and the Chocolate Mountain Aerial Gunnery Range. As noted previously, additional aircraft stationed at Naval and Marine air bases in California or embarked aboard aircraft carriers off of the Pacific Coast also use the BMGR routinely.

The point of this review is that the extent of training service rendered each year because of the BMGR has far reaching benefits within the readiness stature of the nation's tactical air forces. The nation has consequently made a major investment in supporting military air bases in the BMGR, developing infrastructure on the range, and providing the additional training airspace needed to support comprehensive aircrew training programs. Replacing the BMGR at

this point in the nation's history without causing a significant decay in either the existing or the potential levels of training service available to DoD is an almost unfathomable proposition. The nation has several other major training and/or test range complexes, but only Nellis Air Force Range is directly comparable to the BMGR in terms of physical size, scope of training services, and potential training capacity. The activities performed at the BMGR could probably be accommodated at the Nellis Range assuming that that range did not already support a full slate of DoD training and test commitments as well as Department of Energy test programs. BMGR activities could also be accommodated by parceling them out to several smaller Air Force, Navy, and Marine Corps ranges assuming that these ranges were also devoid of existing training and test commitments.

The pattern that quickly emerges from even a cursory planning review for discontinuing use of the BMGR and reallocating its training functions, as relayed above, is that the reallocation task is of such a massive scale that it would cause a pronounced ripple effect through the base and range structure of the DoD. Consequently, the following discussions of potential airspace effects are limited to those that could occur in the BMGR region as a result of not renewing the range. Airspace effects that could occur elsewhere as a result of induced mission changes are not included.

The most probable outcome of not renewing the BMGR would be realignment of a major portion of the aviation training missions in Arizona to bases and ranges elsewhere in the country. This conclusion is reached because of the critical reliance of the training programs at Luke and Davis-Monthan AFBs, Arizona ANG Base at Tucson IAP,

and the WAATS on the BMGR for aviation weapons training. The extent of this dependency is illustrated by the analysis presented previously which shows that 62 percent of the F-16 sorties flown during FY 1996 in R-2301E, R-2304, R-2305, Sells MOA complex, Bagdad-Gladden MOA complex, and Sunny MOA combined occurred within the BMGR component of this airspace. This percentage would be higher for F-16 sorties flown from Luke AFB alone because the above special use airspaces and ATCAAs represent the full compliment of training airspace routinely used by Luke-based squadrons. Luke AFB supports about three-quarters of all of the F-16s based in the BMGR region. The Arizona ANG at Tucson IAP, which supports the remaining quarter of locally based F-16s, uses the Ruby, Fuzzy, Outlaw, Jackal, Morenci, and Reserve MOAs and ATCAAs in addition to the above listed airspace.

The importance of the BMGR is its capacity to support live-fire training. As already reported, 73 percent of all FY 1996 F-16 sorties within R-2301E, R-2304, and R-2305 involved bombing, gunnery, or rocketry. For all aircraft types combined, the proportion of the sorties flown involving ordnance use in this same airspace increases to 78 percent (48,038 live-fire sorties out of 61,895 total sorties). Within R-2301W on the Marine Corps/Navy side of the range, 50 percent of the sorties (5,487 out of 10,975 sorties in FY 1996) are estimated to involve ordnance use. These sorties are flown within the Moving Sands and Cactus West target complexes.

The training programs of the local units that routinely use the Air Force side of the BMGR would face a sharp deficiency in the availability of local training capabilities following the loss of the range. There is simply no other place available within the

normal operating radius of the aircraft flown by these units where the live-fire training that would be precluded by non-renewal of the range could be accommodated. The Chocolate Mountain Aerial Gunnery Range in California is the nearest aviation weapons training range, but at about 17 percent of the size of the BMGR it does not have the reserve capacity needed to absorb the BMGR training load. Even if adequate training time was available, the distance of the Chocolate Mountain Aerial Gunnery Range from Davis-Monthan AFB and the Arizona ANG Base in Tucson is too far to economically support the daily training requirements of these installations. The Chocolate Mountain Aerial Gunnery Range is beyond the unrefueled operations radius of helicopters from the WAATS and would not be a realistic alternative for the daily training sorties of this installation.

One step that could be taken to potentially support some types of training missions following non-renewal of the land component of the range would be to restructure some or all of the BMGR restricted airspace as MOAs and ATCAAs. The value and likelihood of restructuring would be enhanced if authority could also be secured to retain the ground-based GRMDS and TACTS Range facilities following non-renewal of the BMGR. As already noted, MOAs are not regarded as adequate airspace in which to conduct the type of advanced air combat training that occurs on the GRMDS and TACTS Range because of the difficulties participating and nonparticipating aircrews have seeing and avoiding each other. With appropriate safety procedures, however, these missions could potentially be flown in the restructured airspace. MOA airspace and ATCAA have one additional disadvantage for GRMDS or TACTS Range missions. ARTCCs can cap

(i.e., impose a lower than normal ceiling on military operations) or cancel active MOAs or ATCAAs as deemed necessary by ATC to support civil air operations.

The extent to which the R-2301E airspace restructured as a MOA/ATCAA (R-2304 and R-2305 are already included as part of the Sells 1 MOA and ATCAA when not active) supported by the GRMDS could promote the retention of tactical aviation training missions in Arizona is difficult to forecast. Although 7,141 sorties were flown on the GRMDS in FY 1996, these sorties accounted for only about 11 percent of the total use of the Air Force side of the BMGR. In contrast, 78 percent of all sorties flown in the same area involved ordnance use. The GRMDS is used principally for F-16 aircrew training, which is estimated to account for 95 percent of the GRMDS sorties. As noted before, 73 percent of the F-16 sorties flown on the BMGR in FY 1996 involved ordnance use. A-10 aircrew training on the BMGR involved ordnance use on 98 percent of sorties flown in FY 1996. A-10 training involves almost no GRMDS use. Sixty-eight percent of helicopter aircrew training sorties in FY 1996 involved ordnance use. The GRMDS is not useful in training helicopter aircrews.

These data show that while the GRMDS is a critical tool for air-to-air combat training in the F-16, the great preponderance of F-16, A-10, and helicopter training sorties on the BMGR require ordnance use to complete aircrew qualifications and maintain readiness. What these data also illustrate is that the chance of sustaining the existing training missions at Luke and Davis-Monthan AFBs, Arizona ANG, and WAATS are sharply diminished without routine, local access to weapons training ranges on the same scale as currently

available at the BMGR. Consequently, it appears that there would be little or no long-term justification for restructuring R-2301E as a MOA and ATCAA or for maintaining the GRMDS.

Restructuring R-2301W as a MOA and ATCAA coupled with retention of the TACTS Range could be a viable option to support some of the existing Marine Corps and Navy operations on the west side of the BMGR. TACTS Range sorties are estimated to account for about half of all R-2301W sorties. Continuing these training operations within a MOA and ATCAA would not be ideal, as compared to restricted airspace, but could be adequate if ATC requirements for the airspace to support civil aviation did not reach a level where the cost of aborted training missions exceeded the benefits of completed training. Existing airspace operations that could not continue within a MOA/ATCAA include aviation weapons training within the Moving Sands and Cactus West target complexes, the annual HAWK FIREX and Stinger missile shoot, and occasional air-to-air missile shoots. Continued use of Smokey SAMs as a training aid in conjunction with the TACTS Range could be permissible through designation of a Controlled Firing Area.⁴⁸ Aircraft operations at AUX-2 could also be continued if authority could be obtained to maintain AUX-2 as an outlying airfield after

⁴⁸ A Controlled Firing Area contains aerial activities which, if not conducted in a controlled environment, could be hazardous to nonparticipating aircraft. The distinguishing feature of a Controlled Firing Area, as compared to other special use airspace, is that its activities are suspended immediately when spotter aircraft, radar, or ground-based lookouts conducting the required air traffic surveillance indicate that a nonparticipating aircraft might be approaching the firing area. Controlled Firing Areas are not charted because nonparticipating aircraft are not required to change course (FAA 1995).

non-renewal of the BMGR. Ordnance recovery operations at the Marine Corps' live ordnance jettison area would probably be ended.

A decision not to renew the BMGR would not affect Marine Corps and Navy air operations or weapons use at the Chocolate Mountain Aerial Gunnery Range but it would severely impact the semiannual WTI Course which relies on the BMGR as well as the Chocolate Mountain Aerial Gunnery Range. The TACTS Range, tactical ranges (Air Force side), ground support areas, auxiliary airfields, and expansive restricted airspace and land area of the BMGR are the core range assets which, when integrated, make the course not only possible but exceptionally realistic and beneficial. Non-renewal of the BMGR would eliminate any possibility of conducting the course effectively in the BMGR region.

Non-renewal of the range would likely lead to the cancellation of some or all of the MTRs that terminate on the BMGR. Air Force MTRs would likely be prime cancellation candidates. Although some MTR training flights terminate before reaching the BMGR, the subject MTRs were designed to provide low-level ingress all the way to the targets within the tactical ranges. Non-renewal of the range would eliminate the tactical ranges and, as a consequence, the principal objective of training on these MTRs.

The Marine Corps MTRs provide low-level ingress to the TACTS Range area of the BMGR, but because of the lack of live-fire targets, no ordnance is delivered. Rather, aircrews practice low-level approaches and simulated attacks on TACTS Range targets. These routes would not be needed if non-renewal of the BMGR led to elimination of

the TACTS Range. These routes could continue to be useful if the TACTS Range were retained.

The MOAs and ATCAAs in Arizona used by the Air Force would likely be affected by non-renewal of the BMGR. If Air Force training programs in Arizona are markedly reduced or eliminated as a result of non-renewal of the range, the need for one or all of the MOA/ATCAA complexes would also be eliminated. The possibility also exists that the cancellation of one or more of these complexes could lead to further restructuring of the remaining airspace. For example, inactivation of the Gladden-Bagdad complex and designation of a new MOA/ATCAA to replace R-2301W could lead to less use of the Sells complex with a shift of operations to the west into the new MOA/ATCAA.

Moving of the 56 FW training mission from Luke AFB to one or more AFBs elsewhere would lead to the probable cancellation of A-231.

4.2.5 Effects of the Proposed Action on Range Operations

Renewal of the BMGR land withdrawal would establish the authority to continue existing ground-based military activities. All subranges and targets would remain in effect as would the use of auxiliary airfields and ground deployment areas. Existing range EOD, cleanup, and maintenance activities would also continue. The Air Force and Marine Corps would retain the authority to control surface access to the range as necessary to protect the safety of the public and military personnel and to prevent interference with military operations.

4.2.6 Effects of the Alternative Action on Range Operations

The effects of the alternative renewal action on range operations would be indistinguishable from those of the proposed action.

4.2.7 Effects of the No-action Alternative on Range Operations

Non-renewal of the BMGR would terminate DoD authority to use the range land area for military purposes. The effect on military range operations would be significant and adverse.

Non-renewal would be unlikely to trigger an immediate cessation of military training activities on the BMGR. Rather, a Congressional decision in 2001 not to renew the BMGR would probably be accompanied by a directive to the DoD, BLM, and USFWS to develop and implement plans for actions such as:

- # the drawdown and changes of military activities on the range
- # removal and cleanup of discontinued military facilities
- # EOD for existing and former target areas
- # compliance with environmental laws and regulations
- # management plans for future use of the non-renewed range

A period of several years would likely be authorized to accomplish the above activities. One military responsibility that would extend well into the future would be continuing EOD. The expense, difficulty, and danger associated with trying to

decontaminate some range locations such as the HE hill targets could preclude any future use of these areas. P.L. 99-606 provides that locations that cannot be decontaminated be isolated from future use. Maintaining security for such areas and meeting EOD requirements that may continue to emerge long into the future would be a DoD responsibility.

4.2.8 Management Actions

Proposed Action

Implementation of the proposed action would have a positive effect on the continuing capacity of the DoD support tactical aviation training requirements. The DoD would continue to have access to the training airspace, subranges, and support areas of the BMGR. No mitigation would be required to address the effects of the proposed action on airspace or range operations.

The surface use footprint of military operations would be kept to the minimum necessary. A comprehensive review of BMGR operations that was completed in

No-action Alternative

Implementation of the no-action alternative would have significant and adverse effects on the capacity of DoD to support tactical aviation training requirements. The extent to which this effect could be mitigated by converting restricted airspaces R-2301W, R-2301E, R-2304, and R-2305 to MOA/ATCAA combinations cannot be adequately estimated at this time because the planning for training mission changes that would be necessary to make reliable estimates cannot occur until a non-renewal decision is reached. The loss of the aviation weapons training capacity to DoD organizations would be severe and could not be mitigated within the region.

support of the draft LEIS has generated a computer automated inventory of military air and surface uses housed within a geographic information system. This system would greatly assist continuing monitoring efforts to track, assess, and control military surface use requirements. An early use of this new management approach is an ongoing assessment by the Air Force to determine if the size of EOD sweep areas on the range can be decreased without compromising range safety standards. A decrease in the extent of these sweep areas would reduce requirements for off-road vehicle use and range operating costs.

Alternative Action

The airspace and range operations effects of the alternative renewal action are identical to those of the proposed action. No mitigation actions would be required to address the effects of the alternative renewal action on airspace and range operations. As with the proposed action, the surface use footprint of military operations would be kept to the minimum necessary.

4.3 NON-MILITARY LAND AND AIRSPACE USE

4.3.1 Introduction and Significance Criteria

Impacts to non-military land status, land use, and land management of lands within the BMGR are considered to be significant if the action causes more of the range to be restricted to public use, or if existing non-military land uses of the range are displaced or disrupted and cannot be duplicated in the immediate vicinity of the range.

Impacts to land uses along the perimeter of the BMGR are considered significant if one of the following is found to occur with the LEIS alternatives:

- # the action would displace residential, commercial, industrial, agricultural or government facilities or substantially alter current land use practices
- # the action would substantially alter applicable general plans, resource management plans, or the officially stated policies or goals of agencies responsible for managing affected lands
- # the action's off-range effects would substantially change the land use patterns or trends

For civil airspace, impacts are considered significant if the proposed action, alternative action, or the no-action alternative would diminish aviation safety or impede the expeditious movement of civil air traffic or non-BMGR military users.

4.3.2 Proposed Action

Land Status, Use, And Management within the BMGR

Under the proposed indefinite renewal of the BMGR, land status and management of the BMGR would remain as it currently exists, and existing non-military land use within the BMGR would continue, subject to the constraints of the overriding military mission. The proposed action would have, therefore, minimal impact on non-military lands uses within the range boundaries.

No changes would be expected to the land ownership and jurisdiction. Lands within the range boundary would continue to be under the jurisdiction of the BLM, USFWS (Cabeza Prieta NWR) and the BOR. The BLM, USFWS, Air Force, and Marine Corps would continue to participate in the management of non-military land use within the range boundaries.

Non-military land uses of the range (including recreation, international border surveillance, utility rights-of-way, and natural and cultural resource management) would continue with the implementation of this alternative.

Perimeter Land Jurisdiction and Use

There is an inherent difficulty in addressing land use impacts in areas adjacent to where an action is taking place. While impacts to land uses within the range are generally direct and relatively easy to quantify, off-range impacts may be direct or indirect and are more difficult to quantify. When attempting to determine impacts to these land uses, one must consider if there are adjacent land uses that exist specifically because of the existence of the range, or that could not exist as a result of the military reservation and withdrawal.

Under the proposed indefinite renewal of the land withdrawal, general patterns of land status and use along the perimeter of the range would not be expected to substantially change in the foreseeable future. The indefinite range renewal would not displace residential, commercial, industrial, agricultural, or government facilities or alter current land use practices. Existing land uses adjacent to the range would generally be unaffected by continuing the withdrawal, with the exception of noise generated by military activities. Low impacts to perimeter land uses may result from noise and visual intrusions on certain residential uses in the area and on recreational land use in the vicinity of the range including the Cabeza Prieta NWR and Organ Pipe Cactus National Monument. The types of recreation that take place in these areas, as well as awareness by visitors of the military presence, likely result in a greater tolerance of the sounds and sights of aircraft overflight and other training activities.

By continuing to preclude appropriative land uses such as livestock grazing and mining on public lands within the BMGR, there may be increased pressure placed on public lands adjacent to the range to allow for these land uses. Mining and livestock grazing land uses would continue to be constrained from accessing the BMGR resources. However, given the large amount of public lands in the vicinity of the range, the fact that the majority of the study area is remote, and that overall demand for these activities is relatively low, only minimal impacts would be expected.

Future land uses identified along the perimeter of the range were planned or proposed with the knowledge of the existence of the BMGR. Renewal of the military range, therefore, would not be expected to alter those plans or proposals. Furthermore, no formally adopted land management or development prescriptions would be incompatible as a result of implementing this alternative. Future land uses south of Gila Bend and south of Yuma would be constrained by the existence of AICUZ land use compatibility guidelines. Given the remote location of the majority of the perimeter study area, it is assumed that the majority of lands in the vicinity of the range would maintain similar land use characteristics for the foreseeable future.

Civil Airspace

Renewal of the BMGR would not be likely to change general aviation and commercial air carrier access to airspace relative to current conditions. The current configuration of the airspace structure strikes a workable balance among the needs of DoD, general aviation, and commercial air carrier users. Air transport and commerce needs are met as are defense training requirements. The location of the BMGR away from major airports and south of most direct air route pairings between major U.S. cities is advantageous for most air transport and commerce activities.

The relationship between civil aviation and military airspace in the BMGR region could change, however, as the result of two developments—one certain and one speculative. The certain development is the future implementation of a new air navigation concept known as free flight that is emerging as a result of the global positioning system (GPS) and the evolution of GPS navigation receivers. The GPS is based on a system of 24 satellites that provide radio signals that can be used to calculate very precise positions on or over the earth's surface. GPS receivers intercept the satellite signals and perform the requisite computations to identify the position of the receiver. Receivers have been advanced to the point that compact GPS units coupled with navigational computers can be used in aircraft to provide reliable, continuously updated position fixes and navigational guidance to preselected destinations.

Free flight technology is planned to eventually liberate air navigation from the present victor airway and jet route system. Aircrews operating in the free flight system will have much more leeway to plan routes that could yield more cost and time effective flights than the present system. In cases where the present system provides circuitous routing, the yields from free flight will be significant. In other locations, routing in the existing system is direct and no benefits will occur.

Free flight will not give aircrews a completely free hand in selecting air routes. Important constraints in route selection will still be imposed by factors such as:

- # terrain and the capability of the aircraft being flown to safely clear the terrain
- # weather conditions
- # air traffic loads and the need for ATC to eliminate traffic conflicts to ensure adequate safety
- # terminal area airspace and airport approach and departure corridors
- # noise sensitive airspace as at national parks, wildernesses, or residential areas
- # special use airspace

The special use airspace issue is pertinent to the examination of the effects of retaining the BMGR and its restricted airspace. The free flight system alone will not provide separation between nonparticipating aircraft and the hazardous or near hazardous activities that occur within restricted areas, MOAs, ATCAAs, or MTR corridors. Restricted airspace, MOAs, ATCAAs, Alert Areas, and MTRs will continue to be necessary to segregate nonparticipants from hazardous or near hazardous activities or areas of intense military air traffic use. As already noted, the BMGR is south of most of the direct air route pairings between U.S. cities that could become attractive under a free flight operating regime. The direct route connecting the southern California and Yuma areas with Tucson, however, would be through BMGR restricted airspace. Free flight routing through this airspace could be accommodated during daylight hours only

during the rare periods when the airspace is not active. Night free flight operations could potentially be supported through this airspace on a more frequent but not routine basis.

The potential need to accommodate a rising demand for civil free flight through MOAs and ATCAAs elsewhere within the BMGR region could raise conflicts between civil and military needs for airspace. A number of potential direct pairings between Phoenix area civil airports and cities to the west and east lead through the Gladden-Bagdad or Outlaw-Jackal-Morenci-Reserve airspace complexes. These airspace complexes would preclude most civil access to these routings during desirable daytime hours if a full slate of military training is to be maintained. In contrast, priorities that may be assigned for civil air traffic through this airspace could diminish the military aircrew training capacity within the BMGR region. Expected population growth in the Phoenix area and elsewhere in Arizona will lead to continuing growth in civil aviation activities in the region and fuel the airspace access debate.

The speculative development that could impact civil and military airspace access is the potential for new airport construction. Construction of a major airport between Tucson and Phoenix is a proposal that has been the subject of considerable debate over the last 10 years. Although the potential for this project receded with (1) the recent closure of Williams AFB and its conversion to civil use and (2) ongoing construction of a third runway at Phoenix Sky Harbor IAP, new airport construction at some scale remains a potential outcome of the State's continuing population growth. New airport construction within the BMGR region would potentially generate new conflicts over civilian and military airspace needs.

4.3.3 Alternative Action

Land Status, Use, And Management within the BMGR

Impacts to non-military land status and use within the BMGR would be similar to those described for the proposed action. Like the indefinite withdrawal alternative, land status and management of the BMGR would remain as it currently exists, and existing non-military land use within the BMGR would continue, subject to the constraints of the overriding military mission.

Perimeter Land Jurisdiction and Use

Impacts to land status, existing land use, and future land use would be similar to those described for the proposed action. Like the indefinite withdrawal alternative, renewing the range for a period of 25 years would result in low or no identifiable impacts on land status, existing land use, or future land use adjacent to the BMGR. The 25-year range renewal alternative would not displace, alter, or physically affect residential, commercial, industrial, agricultural, or government facilities in the vicinity of the range. Furthermore, general, regional, or resource management plans or other officially stated policies or goals of land management agencies would not change as a result of implementing this alternative.

Primary off-range effects of the BMGR include the noise and sight of aircraft, safety concerns, and access to resources. Noise and visual effects and safety concerns are indirect land use effects that are primarily the result of aircraft operations and other types of military training. Access to resources such as mining/minerals, livestock grazing, and other appropriate land use resources may be constrained as a result of the land withdrawal.

Civil Airspace

The effects on civil airspace of a 25-year renewal of the BMGR with the option to request a follow-on range renewal cannot be differentiated from those foreseen for the proposed actionXa renewal for an indefinite time period. Either the proposed action or the alternative renewal action would presumably make the range available for continued military use until there is no longer a military need for the facility. The only distinguishing differences between these two alternatives are the implied length of the range withdrawal term and the administrative processes required for maintaining the withdrawal (periodic Congressional review under the proposed action) or securing further renewals (additional environmental impact analyses under the alternative renewal action). The foreseeable future for civil airspace is the same under either renewal alternative.

4.3.4 No-action Alternative

Land Status, Use, and Management within the BMGR

Under the no-action alternative, the BMGR's existing land withdrawal and reservation would terminate and military use of the withdrawn land under P.L. 99-606 would end. Under existing authorities, the BLM, USFWS, and the BOR would manage the lands within the existing BMGR withdrawal. Assuming that Congress takes no other action to redefine the non-military administration and the affected lands (e.g., national park or wilderness designation), the BLM-administered public lands would be subject to the multiple resource management objectives of the Federal Land Policy and Management Act (FLPMA). Surface management of the Cabeza Prieta NWR would continue to reside with the USFWS. BOR lands located along the northern tier of the BMGR have previously been identified by the BOR as lands suitable for disposal. Termination of the BMGR's existing land withdrawal and reservation would allow the BOR to dispose of these parcels, which would then be made available to other government agencies.

Management of these former range lands would continue as currently directed until new management planning under FLPMA and NEPA regulations could be completed. Although withdrawal of these lands under P.L. 99-606 from all forms of appropriate land use (such as mining, geothermal leasing, or livestock grazing) would expire, segregation of these lands from appropriate land uses would continue until the Secretary of the Interior publishes an order opening the lands for such uses. An opening order could not be issued by the Secretary until the costs, benefits, and environmental consequences of competing land use could be fully evaluated

through planning directed by FLPMA and reported in NEPA documentation. The results of new land management planning may or may not find that portions or all of the former BMGR lands managed by the BLM should be opened to some or all forms of appropriative land use.

Perimeter Land Jurisdiction and Use

Similar to lands within the range, it is assumed that existing land use management objectives in the vicinity of the range would continue, at least for the foreseeable future. The guidelines for the use of federal lands would be based on information about adjacent land use in the Yuma District RMP and the Lower Gila South RMP. State lands located along the perimeter of the range would continue to be managed in accordance with the state's trust responsibilities. Private lands within the vicinity of the range would continue to be administered in accordance with county or local land management policy. Eventually, a new RMP would integrate on- and off-range lands administered by the BLM.

Because the range lands would remain under the administration of the BLM and no changes would be expected in land status of adjacent lands, the no-action alternative would not be expected to affect applicable general plans, resource management plans, or the officially stated policies or goals of agencies responsible for managing affected lands.

Implementation of the no-action alternative would not displace, alter, or physically affect residential, commercial, industrial, agricultural, government facilities or other forms of land use in the vicinity of the range. In addition, the no-action alternative would not cause lands currently within the BMGR to be incompatible with surrounding existing or future land uses.

Removing the land restrictions and opening up the range for various public uses allowable within federal management guidelines could cause increased pressures on land uses adjacent to the range. Most of the lands immediately adjacent to the range that are currently administered by the BLM are used for grazing. By making the BMGR lands available for other purposes, the no-action alternative could impact grazing allotment boundaries and grazing practices.

It is anticipated that DoD may apply for a lease to continue operations at AUX-2 and the Gila Bend AFAF if the BMGR were not renewed. However, if military operations at AUX-2 and Gila Bend AFAF are discontinued, lands in these areas would no longer be constrained from development because of high noise exposure levels associated with these military facilities.

While the future use of the retired BMGR lands cannot be predicted at this time, the lands could be designated as a wilderness, national park or monument, national wildlife refuge, national conservation area, or Biosphere reserve. Such designation could direct the future of federal lands adjacent to the BMGR to receive the same designation, or to be managed with a different emphasis.

No communities or land uses adjacent to the range exist solely because of the existence of the range. Implementation of the no-action alternative, however, could affect the mission and overall training that is required at MCAS Yuma. As a result, MCAS Yuma's role in the Yuma-area

economy could decrease, potentially resulting in slowed growth and increased availability of housing. If businesses close, there could also be a decrease in the amenities in Yuma and in other communities in Yuma County.

Civil Airspace

The effects of not renewing the BMGR on military airspace in Arizona all point to significant reductions in the extent of this airspace, or its outright cancellation. These effects would generally be negative for continued military aviation training in Arizona but would be positive for civil aviation. Cancellation of the Gladden-Bagdad or Outlaw-Jackal-Morenci-Reserve complexes would have the most positive effects on commercial air transport service and the future of free flight in the Phoenix region. Cancellation of R-2301W, R-2301E, R-2304, and R-2305 would benefit air traffic in and out of Yuma and Ajo as well as the future of free flight through the former BMGR area.

4.3.5 Management Actions

Proposed Action

Implementation of the proposed action would have minimal impact on non-military land uses within the range boundaries or land status and use adjacent to the BMGR. Therefore, no mitigation would be required to address the effects of the proposed action on non-military land use within or adjacent to the BMGR.

General aviation and commercial air carriers would continue to have access to the airspace required to support civil air transportation needs. No mitigation would be required.

Alternative Action

Like the proposed action, the alternative action would have minimal impact on non-military lands uses within the range boundaries, land status and use adjacent to the BMGR, or on civil airspace in the region. No mitigation is required.

General aviation and commercial air carriers would continue to have access to the airspace required to support civil air transportation needs. No mitigation would be required.

No-action Alternative

Implementing the no-action alternative could result in substantial changes to land management and use within the existing BMGR boundaries. Removing the land restrictions and opening up the range for various public uses allowable within federal management guidelines could cause increased pressures on the resources on BMGR lands within the framework of multiple-use management. An order opening the BMGR lands for other types of land use could not be issued by the Secretary of the Interior until the costs, benefits, and environmental consequences of competing land use could be fully evaluated through planning directed by FLPMA and reported in NEPA documentation.

The no-action alternative would likely increase general aviation and commercial air carrier access to airspace currently designated as special use airspace. No mitigation measures would be needed to address effects on these airspace users.

4.4 PUBLIC UTILITIES AND GROUND TRANSPORTATION

4.4.1 Significance Criteria

Impacts to public utilities and ground transportation are considered significant if one of the following is found to occur with the LEIS alternatives:

- # the action causes a utility or transportation department to not meet their present ability to serve and/or future capacity to serve
- # the action would cause an interruption to, or interference of, service

4.4.2 Proposed Action

Within the boundaries of the BMGR, public utilities and ground transportation features include State Route 85; the Tucson, Cornelia, and Gila Bend Railroad; and a portion of Interstate 8, which crosses the BMGR west of the community of Dateland. In addition, a 230kV transmission line has been proposed that roughly parallels State Route 85 through the range from Gila Bend to Ajo. Since the types and level of military use of the range would continue under this alternative, no effects to public utilities and ground transportation would be expected.

The indefinite range renewal would not displace or disrupt service to public utilities and ground transportation features adjacent to the BMGR. Therefore, utilities and ground transportation would be unaffected by continuing the withdrawal.

4.4.3 Alternative Action

Impacts to public utilities and ground transportation under the alternative action would be the same as that described for the indefinite renewal alternative. Like the indefinite withdrawal alternative, renewing the range for a period of 25 years would not be expected to displace or disrupt public utilities or ground transportation facilities or services within or adjacent to the BMGR, resulting in low or no identifiable impacts.

4.4.4 No-action Alternative

Under the no-action alternative, the BMGR's existing land withdrawal and reservation would terminate and military use of the withdrawn land under P.L. 99-606 would end. Under existing

authorities, the BLM and the USFWS would manage the lands within the existing BMGR withdrawal. The BLM-administered public lands would be subject to the multiple resource management objectives of FLPMA. Although withdrawal of these lands under P.L. 99-606 from all forms of appropriative land use would expire, segregation of these lands from appropriative land uses including the possible siting of new utility or transportation facilities would continue until the Secretary of the Interior publishes an order opening the lands for such uses.

Future use of the BMGR lands would be guided by the development of a new resource management plan. As part of this planning process, the potential designation of new transportation or utility corridors would be considered.

For public utilities and ground transportation in the vicinity of the BMGR, the principal difficulty in assessing the consequences of not renewing the range is that projections about land development within or adjacent to the range and the associated changes to the utility and transportation level of service is extremely speculative. For the foreseeable future, implementation of the no-action alternative would not displace, alter, or physically affect public utilities or transportation facilities or services in the vicinity of the range, resulting in no impacts.

4.4.5 Management Actions

Neither the proposed action nor the alternative action would impact public utilities and ground transportation facilities within or adjacent to the BMGR. Therefore, no mitigation would be required.

Implementing the no-action alternative could result in substantial changes to land management and use within the existing BMGR boundaries. Removing the land restrictions and opening up the range for various public uses allowable within federal management guidelines could cause increased pressures on public utilities and ground transportation facilities within and adjacent to the BMGR. Mitigation of the potential effects would involve intensive planning directed by FLPMA and reported in NEPA documentation, including the possibility of additional utility corridors.

4.5 NOISE

4.5.1 Significance Criteria

Noise effects are considered significant when the sound levels that an action would impose exceed the levels regarded as compatible for selected land-use activities. In June 1980, an ad hoc Federal Interagency Committee on Urban Noise published "Guidelines for Considering Noise in Land-Use Planning and Control" relating L_{dn} to compatible land uses. This committee was composed of representatives from the U.S. Departments of Defense, Transportation, and Housing and Urban Development; the EPA; and the Veterans Administration. Since the issuance of these guidelines, federal agencies have adopted the guidelines for their noise analyses.

Following the lead of the committee, the DoD and the FAA adopted the concept of land-use compatibility as the accepted measure of aircraft noise effect. These guidelines and explanatory notes are reprinted in Table 4-1. Although these guidelines are not mandatory, they provide the best means for determining noise impact in communities. In general, residential land uses are normally not compatible with outdoor Day-Night Average Sound Levels (DNL) at 65 dB and above, and the land area and population exposed to DNL of 65 dB and higher provides the best measure for assessing noise impacts.

The land-use guidelines are based on the best available scientific data, including interpretation of noise levels by the “Schultz Curve,” shown in Figure 4-1. This curve, which is widely accepted in the scientific community, predicts the average response of communities to various noise levels. It was first published in 1978 (Schultz 1978) and has been updated and validated several times (for example, Fidell *et al.*, 1991; Finegold *et al.*, 1994). Features represented by this model include a single inflection point – annoyance never going to zero as noise level decreases (some people are always annoyed), and annoyance never going 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 is useful to recognize as a level which, when exceeded, is normally not compatible with residential land use. This is a benchmark often applied to determine residential land-use compatibility. By extension, it is also used as a criterion in planning of airspace. In this EIS it is recognized that affected areas are diverse and it is not necessarily appropriate to use a single criterion. Two other levels are also useful:

- # An L_{dn} of 55 dB was identified by the U.S. EPA as a level “...requisite to protect the public health and welfare with an adequate margin of safety” (USEPA 1972). Noise may be heard, but there is no risk to the public or its welfare.
- # At L_{dn} values below 55 dB, the percentage of annoyance is correspondingly lower. Annoyance is never zero, but at an L_{dn} of 45 dB or less it is considered by most to be small enough to be negligible.

Table 4-1
Land Use Compatibility With Yearly Day-Night Average Sound Levels
8 ½ x 11 B&W

Figure 4-1
Response of Communities to Noise
8 ½ x 11 B&W

4.5.2 Proposed Action

Renewal of the BMGR land withdrawal and reservation for military use for an indefinite period of time with Congressional review every 15 years would mean that the noise environment for the BMGR would remain essentially as it is today (see Table 3-10). Activities on the BMGR that contribute to the majority of the environmental noise include mostly flights by military aircraft in both the low- and high-altitude regimes. However, also contributing to the noise is live-fire training; use of air-to-air cannon fire and missiles; air-to-ground bombs, rockets, missiles, and strafing fire; and surface-to-air missiles. Some of these training events involve munitions with live warheads that explode on impact.

Military Training Route and Weapons Tactics Instructor Flight Operations

Of the more than 17,000 annual aircraft sorties conducted on the 18 MTRs and 5 WTI flight corridors in the BMGR region during 1996, the noise levels were calculated not to exceed an L_{dnmr} value above 55 dB, and approximately half of those sorties resulted in levels less than 45 dB. These calculated noise levels are well within those normally acceptable for residential land use and other noise impact guidelines. Based on the significance criteria, there would be no significant environmental impacts expected from these levels of noise.

Restricted Airspace and Range Operations

The noise levels associated with air-to-air and air-to-ground flight operations on the BMGR are concentrated in the eastern section versus the western section. The number of total flight operations conducted on the eastern section is approximately twice that of the western section. The specific locations of these operations are on the manned ranges 1 through 4 and on East, North, and South TAC ranges. The noise levels in the majority of the land area for these ranges have L_{dnmr} values between 55 and 60 dB. However, while relatively high in relation to the background noise levels, the L_{dnmr} values do not exceed 62 dB. Levels less than 65 dB are normally acceptable for most types of land use and continuation of these range operations would not be expected to significantly impact the environment. In addition, these ranges are within the interior of the BMGR where residential uses are prohibited and in areas of the BMGR where recreational use is not authorized.

Explosive Ordnance Operations

Ordnance dropped on HE hills results in noise levels with values no higher than a L_{cdn} of 93 dB at the center of East TAC, with noise levels that decrease by 15 dB within a mile of the center of the target. While these levels are above those normally acceptable to humans, humans are not authorized to be in these areas during military operations. Animals, on the other hand, would be exposed to these high noise levels if they were in the vicinity during use of the ranges. Thus,

there would not be expected to be any significant impact to the human environment; however, there would be some impact to the animal environment.

Supersonic Operations

Aircraft historically average less than one supersonic event per day potentially resulting in multiple sonic booms, which could propagate to the ground during normal air-to-air engagements over R-2301E, R-2301W, and the Sells MOA. Under these flight conditions with L_{cdn} levels less than 45 dB, the impact at ground level would be negligible and less than 1 percent of the affected population would be expected to be highly annoyed. Thus, there would not be expected to be any significant impact to the environment.

Military Operations Area Operations

Due to the very large expanse of airspace involved with both the Sells and Dome MOAs, the air operations in each MOA result in noise levels that are not much above background noise levels when taken in context of the total aircraft noise over a year. With L_{dnmr} levels less than 45 dB, no significant impact to the environment would be expected from operations in either MOA.

Low-Altitude Tactical Navigation Area Operations

The L_{dnmr} levels in the Sells LATN area are no higher than 47 dB because (1) the A-10 is one of the quietest aircraft in the Air Force inventory, (2) the A-10 conducts more than 96 percent of the total operations in the LATN or approximately 33 flights per annual day randomly throughout the LATN, and (3) the Sells LATN area overlies more than 5,600 square statute miles. As with the MOA operations, noise of this level is frequently less than a typical ambient noise level, as wind and insects sometimes contribute to levels greater than 47 dB. Noise levels resulting from aircraft operations in the LATN would not be expected to significantly impact the environment.

Cumulative Noise Exposure from Military Operations in the BMGR Region

Because noise is logarithmic in its calculation, and not additive, cumulative noise levels of all the subsonic operations in the BMGR are comparatively low, and always less than an L_{dnmr} level of 65 dB. Noise exposure levels on this order are within those normally acceptable to all types of land use provided that noise level reduction is incorporated into structures, and would not be expected to significantly impact the environment.

Noise Exposure for Airfield Facilities within the BMGR

Noise analysis for MCAS Yuma AUX-2 was completed in 1993 as part of the AICUZ program for the installation. The purpose of the AICUZ was to identify incompatible land uses and to assist the local jurisdictions in recommending land use controls to minimize future land use incompatibilities. As depicted in Figure 3-17, the noise generated from military operations at AUX-2 is primarily centered around the airfield within the BMGR. Noise in excess of 65 Ldn associated with the FCLP flight tracks, however, extends to the west of the BMGR boundary onto private and state owned lands. The AICUZ study described incompatible land uses, or impacts, resulting from these noise exposure levels. Because operations at AUX-2 would continue under this alternative, impacts would result to the Southern Mesa recreational vehicle park, a portion of the Pioneer Rancheros subdivision, and 13 separate dwelling units. These residential properties were developed in full knowledge of the military operations in this area.

The noise analysis conducted for the Gila Bend AFAF AICUZ study projected that noise exposure levels exceed 65 dB over some private land northeast of the installation (see Figure 3-18). Because operations at Gila Bend AFAF would continue with this alternative, one residence would continue to be exposed to noise levels exceeding 65 dB.

4.5.3 Alternative Action

The alternative action to renew the land withdrawal and reservation of the BMGR for military use for 25 years would result in the same noise levels as under the proposed action. The only distinguishing differences between these two alternatives are the implied length of the range withdrawal term and the administrative processes required for maintaining the withdrawal. The foreseeable future for the noise environment is the same under either renewal alternative.

Noise Exposure for Airfield Facilities within the BMGR

Like the proposed action, operations associated with AUX-2 would continue under this alternative resulting in impacts to the Southern Mesa recreational vehicle park, a portion of the Pioneer Rancheros subdivision, and 13 separate dwelling units. Likewise, operations at the Gila Bend AFAF would continue resulting in impacts to one residence.

4.5.4 No-action Alternative

Non-renewal of the BMGR would eliminate DoD authority to use the range land area for military purposes. Based on current use patterns, the loss of the land use authority would require the elimination of up to 78 percent of the training sorties flown within R-2301E, R-2304, and R-2305 and up to 50 percent of the sorties flown within R-2301W because these sorties require the use of aircraft munitions. Implementation of the no-action alternative would not necessarily result in a complete reduction in aircraft noise, especially if the military retains the ability to

continue air operation in some or all of the above-mentioned airspace units. It would, however, result in a substantial reduction in noise levels, most especially on the TAC ranges as a result of discontinuing the delivery of live ordnance. An attempt to address further specific noise impacts of not renewing the BMGR cannot be predicted because the types and tempo of military operations that might continue cannot be determined at this time. Thus the projected specific noise impacts as a result of not renewing the BMGR are not included.

4.5.5 Management Actions

Proposed Action

Significant noise impacts associated with AUX-2 and Gila Bend AFAF would continue to result in impacts to residents living near the facilities. At AUX-2, a recreational vehicle park, a low-density residential subdivision, and 13 separate dwelling units would continue to be impacted by this alternative. Near the Gila Bend AFAF, one residential unit would be impacted. Aircraft training operations at these installations have been reviewed to minimize noise impacts to sensitive land uses such as residences. The AICUZ program attempts to mitigate additional future noise impacts in the vicinity of each facility by discouraging incompatible land uses within areas of high noise level exposure.

Under the proposed alternative, the cumulative noise exposure from military operations on the BMGR and noise exposure from aircraft operations in BMGR-associated airspace structures is projected to be less than an L_{dnmr} level of 65 dB. Therefore, these noise exposure levels are considered to be acceptable for all types of land use and there is no significant impact that would require mitigation.

However, perceptions of significance and adversity are subjective and vary among people and cultures. In fact, during public scoping for the LEIS, the largest category of negative comments regarded noise and military use of BMGR-related airspace. The greatest public concern for noise impacts were within the Cabeza Prieta NWR and Wilderness and within the Tohono O'odham Nation. Although these noise levels are projected to be at levels that are considered to be acceptable for all types of land use, there are people who are annoyed by aircraft overflight noise. This annoyance is likely heightened within the Cabeza Prieta Wilderness, because the desire for solitude as part of the wilderness experience may be impacted by noise from aircraft overflight. However, no permanent damage is done to the wilderness aspects of the area. Thus, no mitigation is required.

The Air Force has an ongoing program that focuses on noise-related issues on the Tohono O'odham Nation. The program includes an Air Force Native American liaison who is responsible for communicating, educating, and meeting with the Tohono O'odham Nation as well as compiling noise annoyance data. Flight altitude restrictions and no-fly zones over Tohono O'odham communities are also in place to alleviate noise effects. In 1997, the Air Force proposed to realign six MTRs generally overlying the Tohono O'odham Nation. Although realignment of the MTRs serves no operational purpose, the Air Force proposed this realignment to reduce the effects of overflights at various villages and schools within the Tohono O'odham Nation. This project is currently undergoing environmental review independent of the LEIS process.

Alternative Action

Mitigation measures to reduce noise impacts under the alternative action are the same as those described under the proposed action.

No-action Alternative

Implementing the no-action alternative could result in substantial changes to land management and airspace use of the area in the vicinity of the BMGR. Potential mitigation to reduce noise associated with possible continued aircraft overflight may include the restructuring of times of operation, flight profiles, and flight paths.

4.6 PUBLIC HEALTH AND SAFETY

The BMGR is designed to segregate military training activities within a designated block of land and airspace and exclude nonparticipants, as necessary. As a result, the range has supported years of effective aircrew training without exposing either the public or military personnel to undue hazards resulting from military training activity. Despite the high level of hazards inherent in the training of combat-ready aircrews, the overall health and safety record of the BMGR is excellent. The continued effectiveness of the BMGR is directly dependent on the ability to continue to (1) protect public health and safety, (2) minimize safety risks to military personnel, and (3) prevent interference with training and support activities.

Public access is regularly restricted in 39 percent of the eastern land section and 19 percent of the western land section because the areas contain potential surface dangers from live-fire military training. In all, public entry is regularly restricted to approximately 22 percent of the BMGR. In 43 percent of the eastern land section (18 percent of the BMGR) public access is limited (only authorized when coordinated with range operations personnel). The remainder of the range land surface exists as a safety buffer zone where visitations or other land uses can be controlled as necessary. Land uses such as mining, livestock grazing, agriculture, and intensive recreation are generally incompatible with the levels of access control necessary for range operations and are thus excluded to further reduce danger to public health and safety.

4.6.1 Significance Criteria

The impact assessment for public health and safety involves assessing impacts based primarily on a comparison of existing conditions with the proposed action and alternatives. For public health and safety, much of the impact assessment is qualitative, due to the nature of the proposed action and alternatives considered in the LEIS.

In the following analysis, potential impacts related to public health and safety were considered significant if project implementation would:

- # create a situation involving endangerment or unusual risk to military personnel, visitors to the BMGR, or to residents and visitors of lands adjacent to the range
- # expose humans to dangerous or hazardous materials, waste, or conditions

4.6.2 Proposed Action

In assessing the impacts of an indefinite withdrawal alternative on public health and safety, it is important first to make some assumptions about the type of military training that may take place in the future. Perhaps one of the best indicators of future military training activities is recognition that military land use on the BMGR, as represented by target complexes and other training support facilities, has not changed substantially since the late 1960s. The training facilities utilized during this time period have, for the most part, been able to accommodate tactical aviation training on the BMGR in spite of drastic evolutionary changes that have occurred in aircraft, weapons systems, and air combat tactics. Therefore, it is reasonable to assume that, with some relatively small-scale adjustments, the BMGR would continue to be compatible with the aircrew training needs of the foreseeable future. Military activities would continue to be concentrated within established target impact areas and ground support areas, which constitute a relatively small proportion of the total range land area.

The primary objectives of renewing the range withdrawal is to allow military aviation and associated ground training to occur without exposing civil aviation users, military aircrews, or people on the ground to unacceptable hazards induced by those training activities. As a result of implementing the indefinite withdrawal alternative, large portions of the BMGR would continue to be unavailable for public use, including recreational use, for an indefinite period of time because of the safety requirements imposed by military use. This includes a large part of the eastern section of the range and the far western portion of the western section of the range. Public recreation use would continue to be focused primarily in Air Force Management Areas A and B on the eastern section of the range, Cabeza Prieta NWR, and the majority of the western section of the range located east of the Moving Sands/Cactus West target area including the El Camino del Diablo (see Figure 3-19). Public access to military operation areas including manned ranges, tactical ranges, target areas, and other high hazard areas would continue to be highly restricted to protect public safety.

In general, implementation of an indefinite range renewal of the BMGR would result in little or no increased public health and safety concerns as compared to existing conditions. The proposed action would continue to provide limited public access to the range especially for recreational purposes.

Existing range entry procedures, including the safety briefing and entry permit system, would not be expected to change in the near future. However, increasing population and corresponding

demands for increased use of recreation areas in southwestern Arizona may lead to additional unauthorized access to the range.

No changes are anticipated in the use of chaff and flare on the BMGR, and thus no resulting public health and safety impacts would occur. As discussed in Section 3.7.2, the materials in chaff are generally non-toxic (except in quantities significantly larger than those any human or animal could reasonably be exposed to). Air quality concerns regarding chaff use address the potential for chaff to break down into respirable particles, and the possibility that hazardous air pollutants may be generated from the pyrotechnic impulse charges used with some chaff types. Chaff particulate tests and a screening health risk assessment concluded that these are not significant concerns.

The potential for chaff to affect soil and water is remote. Laboratory tests of chaff, using a modified toxic characteristics leaching procedure, indicated little or no potential for adverse effects on soil. No adverse impacts on biological resources have been identified. Based on their digestive processes, few animals are expected to suffer physical effects from chaff ingestion. Effects from inhalation are not considered a significant issue, since chaff particles would represent a small percentage of the particulates regularly inhaled by animals (U.S. DoD, Air Force 1997).

The primary potential impact associated with flare use is the possibility of burning material reaching the ground and igniting a fire, which could create secondary environmental impacts. As previously stated, target illumination flares are usually released at above 5,000 feet AGL and are designed to burn out before reaching the ground. Luke AFB Supplement 1 to AFI 13-212 restricts the use of defensive flares within R-2301E, R-2304 and R-2305 to a minimum release altitude of 300 feet AGL when no fire hazards are present and a minimum of 1,000 feet AGL when fire hazards are present.

Toxicity is not a concern since magnesium, the primary metal found in flares, is not highly toxic, and it is extremely unlikely that humans or animals would ingest flare material. Impulse charges used with some flares contain chromium and, in some cases, lead, which are hazardous air pollutants under the Clean Air Act. A screening health risk assessment concluded that they do not present a significant health risk in the quantities involved. Laboratory analyses of the flare pellets and flare ash indicate that these materials have little potential for affecting soil or water resources (U.S. DoD, Air Force 1997).

Executive Order 13045, Protection of Children from Environmental Health Risks and Safety Risks (21 April 1997) recognizes that children may suffer disproportionately from environmental health risks and safety risks. These risks arise because children's bodily systems are not fully developed; they eat, drink, and breathe more in proportion to their body weight than adults; children's size and weight may diminish protection from standard safety features; and their behavior patterns may make them more susceptible to accidents. Based on these factors, the executive order directs each federal agency to make it a high priority to identify and assess environmental health risks and safety risks that may disproportionately affect children. Each federal agency is also to ensure that its policies, programs, activities, and standards address disproportionate risks to children that result from environmental health risks and safety risks.

Because the BMGR is uninhabited by humans and no hazards associated with the BMGR extend beyond the range boundary, there is no disproportionate health or safety risk to children. Hazards associated with the portions of the range where recreational access is authorized primarily relate to environmental hazards such as extreme temperatures, flash floods, and venomous wildlife. These types of hazards are inherent to the Sonoran Desert and are not a result of the military reservation designation. Although designated recreation areas are generally non-munitions impact areas today, they may have been used as target areas in the 1940s or 1950s resulting in the potential for contact with unexploded munitions. All visitors to the BMGR must receive advisories of these hazards.

4.6.3 Alternative Action

Impacts to public health and safety resulting from a 25-year withdrawal alternative are expected to be similar to those described for the proposed action. Like the proposed indefinite withdrawal, implementation of the 25-year withdrawal alternative would result in little or no increased public health and safety concerns as compared to existing conditions. Over the next 25 years, it is assumed that existing target and training areas would remain in place; no drastic changes in the ground or airspace use are anticipated. Opportunities for public access of the range, especially for recreational purposes, are expected to continue with the likelihood of increased recreational demand that may result in additional unauthorized access to the range. In the foreseeable future, large portions of the BMGR would continue to be unavailable for public use, including recreational use, because of military exercises and facilities.

Population growth in the vicinity of the range over the next 25 years is expected, especially in Yuma, Gila Bend, and Ajo. Because this growth and development is occurring outside of the BMGR boundary, public health and safety concerns are minimal.

4.6.4 No-action Alternative

With the no-action alternative, hazards associated with military training (such as air and ground mishaps, potential burns from lasers, and radiation from microwaves) would be eliminated.

Further action would be required to determine if the Air Force would continue aircrew training in the absence of a land withdrawal. It is possible that some air-to-air training missions could continue in the BMGR associated airspace.

If the BMGR land withdrawal is not renewed, DOI, in consultation with the Secretary of the Air Force, must determine if decontamination of the land is practicably and economically feasible. This determination must be made in consideration of the potential future use and value of the land and would require the development of a decontamination plan and additional NEPA documentation. The Secretary of the Air Force is responsible for decontaminating the land to the extent that funds are appropriated for such purpose.

As was described in Section 3.3.3, the 56th EOD Flight and the Marine Corps Range Management EOD personnel maintain an ongoing program of surface EOD. P.L. 99-606 requires the Air Force to periodically decontaminate the BMGR to at least the level of cleanup achieved in 1986. Public access to the BMGR could be expected to increase after decontamination.

4.6.5 Management Actions

Proposed Action

Because implementation of the proposed action would result in little or no increased public health and safety concerns as compared to existing conditions, no mitigation would be required to address the effects of the proposed action on public health and safety. Ongoing efforts that would be continued throughout the renewal period are summarized below.

- # Large portions of the BMGR, including manned ranges, tactical ranges, target areas, and other high hazard areas, would continue to be unavailable for public use in order to keep people away from high hazard areas.
- # Public access to the BMGR would continue to be authorized only after completion of the permit process, which would include signing a hold harmless agreement.
- # EOD teams would continue to clear munitions from the surface of the manned and tactical ranges, and the Moving Sands/Cactus West target complex.
- # Fences and/or warning signs marking the boundary of the BMGR as well as interior hazard areas such as live-fire ranges, laser hazard areas, EOD operating areas, and abandoned mines and wells, would continue to be posted and maintained.
- # A periodic survey of access points along the range perimeter (including along any new boundary alignments) and of interior hazard areas would be conducted to ensure that needed safety fences, gates, and signs are in place.

Alternative Action

Like the proposed action, the alternative action would have minimal public health and safety impacts. The ongoing public health and safety efforts outlined above under the proposed action would continue.

No-action Alternative

Implementing the no-action alternative would result in eliminating many public health and safety concerns currently associated with the range. Prior to opening the range to public use, the Air Force must first determine if decontamination is practicably and economically feasible. Potential mitigation measures would include the development of a decontamination plan and additional

NEPA documentation. Additional mitigation may include closing access to areas where potential public health or safety concerns may exist until such time that such concerns can be reduced to an acceptable level or eliminated.

4.7 CULTURAL RESOURCES

4.7.1 Regulatory Considerations and Significance Criteria

An important aspect of this analysis is that cultural resources will continue to be considered during post-LEIS agency compliance procedures. These may relate either to continued military use, or to non-renewal of the land withdrawal followed by resumption of administration by the BLM and continued administration of the Cabeza Prieta NWR by the USFWS. If one of the action alternatives is adopted, cultural resource management will be conducted in accordance with (1) an existing programmatic agreement developed by MCAS Yuma as an aspect of their compliance with the National Historic Preservation Act (NHPA) for administration of the YTRC (Appendix F); (2) a programmatic agreement currently being developed for management of World War II auxiliary airfields (to be included in the Final LEIS in Appendix F); (3) an integrated cultural resources management plan (ICRMP); and (4) a programmatic agreement to implement the ICRMP (to be included in the Final LEIS in Appendix F as a draft; anticipated completion date: March 2000). The ICRMP is currently under development for the BMGR in consideration of NHPA requirements as well as those of other heritage preservation legislation, with related documents that address treatment of human burials and repository requirements (ICRMP; anticipated completion date: October 1999). Should the no-action alternative be adopted, continued compliance with the NHPA and related laws would be required of the Air Force during deactivation. Thereafter, the BLM and USFWS also would continue to be required to manage cultural resources in compliance with the NHPA and other applicable heritage preservation legislation. The ICRMP is intended to serve all agencies with current management responsibilities on the BMGR, including the Air Force, MCAS Yuma, BLM, and USFWS. It is anticipated that the ICRMP and its implementing programmatic agreement (amended or revised as appropriate) will continue to provide the basis for the management of the cultural resources on the BMGR after the conclusion of the LEIS and the land withdrawal application process in 2001, regardless of the outcome of that process.

There are no established standards for assigning levels of significance of impacts to cultural resources as they are ordinarily assessed under NEPA. However, regulations (published at 36 CFR 800.9) that implement Section 106 of the NHPA identify three levels of "effect" that a proposed undertaking may have on cultural resources determined eligible for listing on the National Register (historic properties).

An undertaking is determined (by a federal agency in consultation with the State Historic Preservation Officer [SHPO]) to have an "adverse effect" when its impact on a historic property may diminish the integrity of the property's location, design, setting, materials, workmanship, feeling or association. Adverse effects can be caused by physical alterations; alteration of the property's setting; introduction of visual, audible, or atmospheric intrusions on a property's

setting; neglect that results in deterioration; or transfer, sale or lease of the property. Determinations of “adverse effect” are most commonly associated with undertakings that impact historic properties determined eligible for National Register listing under criteria A, B, or C (usually buildings and structures), or in cases where disturbance of human remains is anticipated. Impacts to traditional cultural properties are likely to be considered adverse as well.

Determinations of “no adverse effect” are made (1) when the historic property is of value only for its research potential, and when such value can be substantially preserved through the conduct of appropriate research or data recovery; (2) when the undertaking is limited to the rehabilitation of buildings and structures and is conducted in a manner that preserves the historical and architectural value of the property, and (3) when the undertaking is limited to the transfer, sale, or lease of a historic property, and adequate restrictions or conditions are included to ensure preservation of the property's important historic features. Determinations of “no adverse effect” are most commonly associated with undertakings that impact historic properties determined eligible for National Register listing under criterion D (usually archaeological sites) and are unlikely to contain human remains.

A determination of “no effect” is made when (1) the undertaking can be redesigned to avoid effects to an eligible property, or (2) when only elements of an eligible property that do not contribute to its importance will be affected.

Because inventory of the BMGR is incomplete, the programmatic agreements described above are being developed to demonstrate compliance with Section 106 of the NHPA. These agreements will include commitments to future inventory and mitigation of effects to historic properties within areas subject to impact. However, because inventory and assessment of the importance of cultural resources within areas subject to impact is incomplete, determinations of effect have yet to be made.

It is conceivable that visual and auditory intrusions on properties determined eligible under criteria A, B, or C would be considered significant impacts if adequate mitigation could not be designed.

A more likely potential for an identification of significant impact is the possibility that there could be traditional cultural properties (TCPs) within the BMGR. It remains for in-progress ethnographic research to discover if this is the case. If traditional cultural properties are present, and it is determined that they are being adversely affected (either by visual or auditory intrusions from low flying aircraft, or by actual physical disturbance) it may be very difficult to identify adequate mitigation measures. Thus, effects to traditional cultural properties may result in significant residual impacts despite the application of mitigation.

4.7.2 Potential Impacts

Cultural resources may be subject to impact (effect) from direct physical disturbance as well as unwanted visual, auditory, or atmospheric intrusions. Physical disturbance is caused by military activities including ordnance delivery (creating bomb craters for example); ordnance clean up by EOD personnel, which involves off-road vehicular use; deployment of troops and vehicles during various training exercises; and various maintenance activities that cause ground disturbance (such as road grading). No potential impacts from atmospheric intrusions are envisioned on the BMGR. Visual and auditory intrusions ordinarily pertain only to cultural resources valued for characteristics other than their information content and for which there is public sentiment for in-place preservation in an *unaltered setting*. These might include TCPs or other properties determined eligible for National Register listing under criteria other than D. Low-level overflights (1,500 feet AGL or lower) or supersonic flight speeds with associated “sonic booms” could be considered disruptive from visual and auditory perspectives, and thus, have the potential to cause negative intrusive impacts to these cultural resources. The presence of objects such as DARTs also might be regarded as visually intrusive.

Cultural resources recorded to date on the BMGR include primarily archaeological sites that ordinarily are recommended and determined eligible for National Register listing under criterion D, that is, for their information potential. Direct impacts to archaeological sites and other properties including standing buildings and structures will vary as a function of property type, terrain, and ground disturbing activities. Whatever the conditions and circumstances, however, ground disturbing activities can be expected to affect the integrity of any cultural resources in their immediate vicinity. The potential for direct physical impacts to cultural resources can be anticipated as a consequence of any military ground operations that cause appreciable disturbance to the natural ground surface including air-to-ground ordnance delivery.

Potential impacts associated with aircraft mishaps such as crashes also can be anticipated, but those effects are judged to be rare and minimal compared to impacts from ground operations and ordnance delivery. Impacts to cultural resources also can occur as a result of non-military activities on the BMGR. These include activities associated with surveillance of the international border such as the construction and maintenance of “drag roads” and off-road vehicular use, construction and maintenance of transportation and utility corridors, recreational activities, inadvertent or intentional vandalism; and actions carried out by the BLM, USFWS, and the AGFD. Non-military impacts are to be considered during development of the ICRMP, which will include recommended mitigation measures for both military and non-military effects to cultural resources.

4.7.3 Proposed Action

Under the proposed action, effects to cultural resources would continue to be mitigated in compliance with Section 106 of the NHPA and specifically in accordance with updated versions of the ICRMP and its implementing programmatic agreement, both of which will require assessment of the need for revision every five years. Stipulations of a Plan of Action and

Comprehensive Agreements to be negotiated with individual Native American communities in compliance with the Native American Graves Protection and Repatriation Act (NAGPRA) also would continue to be followed, as would consideration of recovered archaeological materials under the Collections Management Plan currently being developed. As stated in Section 2.2, a renewal with an indefinite term would facilitate long-term planning that integrates military objectives with cultural resource management goals.

In sum, cultural resources may be affected by physical disturbance, and specific kinds of cultural resourcesXproperties determined eligible for National Register listing under criteria A, B, or C including TCPsXalso might be affected by visual and auditory intrusions. Potential for physical disturbance is considered first.

Possible Physical Disturbance

To date, only about 5 percent of the surface of the BMGR has been inspected for cultural resources. The following discussion, therefore, considers known cultural resources but also is based in part on a predictive model that describes expected archaeological sensitivity as that relates to distinct environmental parameters (Bruder and others 1996). Briefly, the model predicts that the highest archaeological sensitivity can be expected in proximity to *tinajas* (rock tanks that hold water for portions of the year) where an average of 23.7 sites per square mile is expected. Moderate archaeological sensitivity is characteristic on upper bajadas, in foothills and mountain valleys, adjacent to playas, and in proximity to major washes. An average of 3.3 sites per square mile is expected in areas of moderate archaeological sensitivity. Low archaeological sensitivity is expected on steep mountain slopes, lower bajadas, and valley floors away from major washes; in these areas, an average of 0.3 site per square mile is expected.

Eastern Section of the BMGR: Possible physical disturbance to cultural resources from military activities in the eastern section of the BMGR can be expected within the four manned and three tactical ranges; in the vicinity of Stoval Field; at Auxiliary Airfields (AUXs) 6, 7, 8, 9, 10, and 11; and to a much lesser extent within the Air-to-Air Range Complex. Known and expected cultural resources within each of these areas are listed below. The locations of the auxiliary airfields are illustrated in the subject programmatic agreement (Appendix F).

Each component where ground disturbance is evident on aerial photographs at each of the manned ranges has been intensively surveyed for archaeological and other cultural resources, however, most of the associated EOD sweep areas have not been surveyed. Two archaeological sites are present within the surveyed areas at Range 1; just one is recommended eligible for National Register listing, under criterion D. No archaeological sites or other cultural properties are present within the surveyed areas of Range 2. At Range 3, two archaeological sites were recorded within the surveyed areas, one recommended eligible for listing under criterion D and the other requiring testing in order to formulate a recommendation. Range 4 contains six archaeological sites within areas that were surveyed, of which three are recommended eligible under criterion D, one requires testing, and two are recommended to lack sufficient information potential to qualify for listing. In sum, seven archaeological sites recommended eligible or

potentially eligible for listing on the National Register for their information potential are subject to impact within the surveyed areas of the manned ranges. As stated earlier, the EOD 11.2-square-mile sweep areas surrounding the targets at the four manned ranges have not been inventoried with the exception of one square mile at Range 3. The archaeological sensitivity model described above predicts that about 70 sites may be present within these unsurveyed sweep zones.

The North and South tactical ranges are discussed together because they abut one another and thus can be considered a single unit from a cultural resources perspective. Physical disturbance of cultural resources is expected to be greatest within the one-year EOD sweep zone, which encompasses 26.7 square miles (sq mi); the munitions footprint is largely confined to this zone. Within the 91.9 sq mi, 5-year EOD sweep zone, somewhat less, but nonetheless substantial impacts to cultural resources are anticipated. To date, intensive cultural resources inventory surveys have been conducted throughout 46 percent (12.3 sq mi) of the 1-year EOD sweep zone; close to 33 percent (30.1 sq mi) of the 5-year EOD sweep zone has been inventoried. Respectively, these surveys have recorded 40 archaeological sites and 119 archaeological sites. National Register eligibility recommendations have not been definitely formulated for all of these sites as of this date, but most are expected to be regarded as eligible under criterion D. Of the remaining unsurveyed 14.4 sq mi of the one-year sweep zone, about half is regarded as moderately sensitive from an archaeological perspective and the other half is regarded as low in sensitivity. Using the predictive model, this means that about 26 as yet unrecorded archaeological sites may be present within the 1-year sweep zone. Similarly, the model predicts about 111 additional archaeological sites may be present within the 61.8 sq mi of unsurveyed area in the 5-year sweep zone

The one-year EOD sweep within the East Tactical Range encompasses 13.9 sq mi; the five-year sweep comprises an additional 53.8 sq mi. Approximately 66 percent (9 sq mi) of the one-year sweep zone has been intensively inventoried, with 27 archaeological sites recorded. An additional 131 sites have been recorded within the five-year sweep zone, of which just over half (27.4 sq mi) has been surveyed. Most of these sites likely will be considered eligible for National Register listing for their information potential. Unsurveyed portions of the EOD sweep zones aggregate to 31.3 sq mi, two-thirds predicted to be of moderate archaeological sensitivity with the remaining judged to be low in sensitivity. Thus the model predicts about 70 additional archaeological sites may be present within unsurveyed portions of the EOD sweep zone on the East Tactical Range.

There are eight auxiliary airfields that were constructed during World War II on the BMGR along with the Gila Bend AFAF. The Gila Bend AFAF and Yuma AUX-2 (in the western section of the BMGR) both have been determined not eligible for National Register listing because of a loss of integrity; thus it is not necessary to consider impacts to these two facilities. Five of the other seven auxiliary fields have been determined eligible for listing under criterion A, and four of these also have been determined eligible under criterion D. AUX-7 and AUX-9 have not been evaluated, but probably would be regarded as eligible under criterion A. Archaeological sites determined eligible or potentially eligible for listing under criterion D are associated with AUX-6, AUX-8, and AUX-11. An archaeological component associated with Stoval Field also is

reported, but would require testing for a recommendation regarding eligibility for listing on the National Register. With one exception, all of the airfields and associated archaeological sites or components may be impacted by current or planned future use of the facilities for troop deployments associated with various training scenarios that involve the use of heavy equipment and helicopters and require limited excavations such as “fox holes.” The airfields themselves also are subject to natural deterioration because they are not being maintained.

The portion of the Air-to-Air Range Complex within the portion of the BMGR withdrawn from the BLM encompasses 158 sq mi, of which 4.3 percent (6.8 sq mi) has been subjected to intensive archaeological inventory. Within this area, 25 archaeological sites are recorded; most of these sites are recommended eligible for their information potential. Using the sensitivity model, an additional 347 archaeological sites are expected within the ground footprint of the Air-to-Air Range Complex, about two-thirds of which is projected to be of moderate sensitivity and one-third projected as low in sensitivity. All may have been subject to minimal disturbance from falling Deployable Aerial Rigged Targets (DARTs) in the past (the use of DARTs has been phased out in recent years), but the risk of substantial impact is low to negligible because ground disturbance caused by a falling DART typically is limited to less than a foot in diameter. If DART removal were to be undertaken, however, impacts from off-road vehicular use might be anticipated.

Air Force Management Areas A, B, C, and D are open to restricted public access. Therefore, cultural resources in these areas may be subject to either intentional vandalism or inadvertent disturbance from recreational activities to a greater extent than resources in military use areas. Surveys conducted to date within these areas and the Sentinel Plain Lava Flow SRMA and the Crater Range SRMA, as well as numbers of known and projected archaeological sites (using the sensitivity model described above), are provided in Table 4-2.

TABLE 4-2 CULTURAL RESOURCE SURVEY DATA FOR SPECIAL MANAGEMENT AREAS IN THE EASTERN SECTION OF THE BMGR				
Location	Size (mi ²)	Surveyed (mi ²)	Recorded Sites	Projected Sites
Area A	139.0	19.0 (14%)	121	273
Area B	186.5	3.0 (2%)	35	330
Area C	40.5	1.0 (3%)	5	51
Area D	15.5	1.0 (6%)	2	34
Sentinel SRMA	143.8	9.7 (7%)	8	438
Crater SRMA	18.6	1.0 (5%)	16	33

Western Section of the BMGR: In the western section of the BMGR, which is used principally by MCAS Yuma and its tenant units, physical disturbance to cultural resources from military activities might be associated with the use of the Moving Sands and Cactus West targets, AUX-2, the parachute drop point, an EOD operations area and live ordnance jettison area, the rifle range, Cannon Air Defense Complex, a number of ground support areas and Stinger Team operation zones used principally during WTI, and the TACTS range. Known and expected cultural resources within each of these areas, all of which are included in the YTRC, are considered below.

Cultural resource survey records of the Moving Sands or Cactus West targets and their respective run-in lines have not been located, although a 2-acre parcel was surveyed by the BLM in the Moving Sands vicinity; no cultural resources were found. An environmental assessment was prepared for both targets by MCAS Yuma and it is believed archaeological surveys were conducted but never put on file because no cultural sites were identified. Surface observations indicate that original target installation and subsequent use would have obliterated any cultural resources that might have been present. The same is true for the original grading of the run-in lines. Both targets are in areas of low archaeological sensitivity as are the majority of the run-in lines. The run-in lines, each of which extends for about 12 miles, pass through a 2-mile-long stretch judged to be of moderate archaeological sensitivity.

As stated above, AUX-2 has been determined not eligible for National Register listing. No archaeological sites are present in the immediate vicinity of the airfield. Therefore, continued use of this facility will have no impact on important cultural resources. The parachute drop point is in a heavily disturbed area near AUX-2. It apparently was not subjected to archaeological survey prior to being used, but is in an area characterized as low in archaeological sensitivity. The same is true for the EOD operations area and live ordnance jettison areas. The rifle range and Cannon Air Defense Complex both are in an area judged to be low in archaeological sensitivity. Each was intensively surveyed and no cultural resources were reported. No impacts to cultural resources are anticipated from continued use of these facilities.

Currently used ground support areas (including Stoval and AUX-2 airfields) encompass approximately 19.6 sq mi. Of that total, about 14.5 square miles (or 80 percent) have been intensively surveyed. The unsurveyed acreage includes approximately two-thirds moderate and one-third low archaeological sensitivity zones. Twenty archaeological sites are known to be present within the currently established ground support areas, and seven additional sites are recorded within areas frequently used by Stinger Teams. (The acreage of the Stinger Team operations areas has not been specifically quantified.) Of these 27 sites, 20 have been determined not eligible for National Register listing (or in the case of the segment of El Camino del Diablo potentially subject to impact, to be a non-contributing element in terms of the overall significance of the resource). The seven sites determined eligible under criterion D could suffer incremental degradation with continued use of the ground support areas in the absence of mitigation. The same is true for the expected 12 sites in the non-surveyed portions of the operations areas.

Continued use of the TACTS range facilities is not anticipated to cause impact to cultural resources. Apparently all of the TACTS facility locations have been inventoried for cultural resources, although because some of this work was done over 15 years ago, the documentation is difficult to track. In any case, visual inspection indicates that original installation of the facilities would have obliterated any resources that might have been present. TACTS range targets, mobile instrument sites, and emitter sites are relatively small facilities, each covering less than an acre. The facilities are located in moderate to low archaeological sensitivity zones.

Cultural resources in the western section of the BMGR are at greater risk from non-military use (intentional vandalizing and inadvertent disturbance) than the resources in the eastern section

because the public gains access to the area using permits and by unauthorized entry. To complete the characterization of possible impacts to cultural resources in the western section of the BMGR, surveys conducted to date and numbers of known and projected sites within BLM administered ACECs are provided in Table 4-3.

TABLE 4-3				
<i>CULTURAL RESOURCE SURVEY DATA FOR</i>				
AREAS OF CRITICAL ENVIRONMENTAL CONCERN IN THE BMGR				
Location	Size mi²	Surveyed	Recorded Sites	Projected Sites
Tinajas Altas Mountains ACEC	94.5	12.0 (13%)	50	151
Gran Desierto Dunes ACEC	39.8	0.0 (0%)	0	12
Mohawk Mountains and Sand Dunes ACEC	206.3	4.6 (2%)	17	212

Cabeza Prieta NWR: Just over a square mile has been systematically surveyed within the Cabeza Prieta NWR although more extensive reconnaissance efforts also have been conducted. Thirty archaeological sites and the Ajo Radar Station, which is a Cold War facility, have been formally recorded. Likely most of the archaeological sites would be regarded as eligible for National Register listing under criterion D. In a “consensus determination,” the Ajo Radar Station was determined not eligible for listing. In terms of archaeological sensitivity, the Cabeza Prieta NWR is about evenly divided between moderate and low sensitivity zones, with 14 high sensitivity *tinajas* known to be present. Thus probably there are thousands of archaeological sites throughout the Cabeza Prieta NWR, many of which are likely to be considered eligible for National Register listing. Impacts from military activities, however, are minimal. The Air-to-Air Range Complex extends over the Cabeza Prieta NWR and a single TACTS range mobile instrument site along with four GRMDS instrument sites are situated within it. As stated above, ground disturbance associated with these military actions is not substantial. Other than occasional impacts from errant ordnance intended for delivery on the South Tactical Range or rare downed aircraft, no other military ground disturbance is anticipated. Because much of the area is a wilderness area as well as a wildlife refuge, non-military impacts to cultural resources also can be expected to be minor.

Possible Visual and Auditory Intrusions

Recorded properties potentially subject to visual and auditory intrusions as well as physical disturbance are those that have been determined eligible for National Register listing under criteria A, B, or C, and for which there may be public sentiment for in-place preservation in an *unaltered setting*. TCPs might be included among such properties, but none have been identified on the BMGR as of this writing.

Of the 605 cultural properties included in the BMGR database to date, just one, El Camino del Diablo (a historic travel route), is actually listed on the National Register, and is regarded as

eligible under criterion A. Additionally, consultation among Luke AFB or MCAS Yuma, the BLM, and the Arizona SHPO has resulted in consensus determinations of eligibility for seven properties regarded as qualifying for listing under criterion A, and another under criterion C. The seven "A properties" are the aforementioned World War II airfields. The "C property" is an intaglio. An additional 15 properties are recommended eligible under A, B, or C.

Existing flight corridors used both by fixed-wing and rotary-wing aircraft have the potential to negatively alter the setting of El Camino del Diablo where it cuts through the Cabeza Prieta NWR. As stated above, the portion of the road on the BMGR outside of the Cabeza Prieta NWR has been determined not to contribute to the property's significance because its integrity has been degraded. Much of the road outside of the Cabeza Prieta NWR is graded and maintained as a drag road by the U.S. Border Patrol. A stipulation in the MCAS Yuma programmatic agreement calls for an assessment of El Camino del Diablo throughout the Cabeza Prieta NWR to identify contributing and non-contributing segments. Whether the frequency and intensity of overflights cause visual and auditory intrusions that are regarded as significant by the public who might wish to experience the trail in an unaltered setting also is a question to be considered in the future in accordance with stipulations of MCAS Yuma's existing programmatic agreement for administration of the YTRC within Arizona. It is probable, however, that these intrusions will not be regarded as creating an adverse effect because other, perhaps more intrusive elements such as regular maintenance and vehicular traffic, already create a setting that diverges from the historic look and feel of this historic travel route. Of the total flight time over the Cabeza Prieta NWR, the time over El Camino del Diablo in total accumulates to approximately 12 minutes of helicopter traffic and 4.1 hours of fixed-wing aircraft traffic annually. Because its setting already includes evidence of modern America, such occasional overflights probably will not constitute an adverse effect. Public input also is required to determine if DARTs that can be seen from El Camino del Diablo are considered visually intrusive. Similar considerations will be developed with regard to the other determined or recommended "A, B, or C properties" in the ICRMP and addressed in its implementing programmatic agreement.

Mitigation Potentials and Anticipated Effectiveness

Impacts to cultural resources listed on or determined eligible for listing on the National Register would be regarded as significant only in the event those impacts could not be satisfactorily mitigated by (1) avoidance achieved through restructuring or redesign of a given military activity and development and administration of educational briefings to ensure avoidance where appropriate; (2) recovery of a representative sample of data prior to disturbance; (3) archival research; or (4) preservation of selected examples of similar or nearly identical property types. It is important to be aware that a determination of "adverse effect" under the NHPA would not necessarily equate with a significant impact under NEPA. "Adverse effect" determinations under the NHPA are indicated in almost all cases where effects to properties determined eligible for National Register listing under criteria other than D are anticipated, and in cases where there is a possibility human burials may be disturbed. Ordinarily, in either case, mitigation to at least partially offset the adverse effect usually can be designed, and the residual impacts are not necessarily significant.

Mitigation measures to offset or reduce the potential impacts specified above have been designed for some of the known and expected cultural resources, and additional mitigation strategies are to be identified as the ICRMP is developed. Mitigation developed to date is outlined here.

Mitigation for Archaeological Sites

Archaeological sites determined or recommended eligible for their information potential are the most numerous cultural resources on the BMGR. Military impacts to these sites are anticipated within Ranges 1-4, within the ordnance delivery and EOD sweep zones at all three tactical ranges, associated with use of at least three of the auxiliary airfields, and within ground operations areas and Stinger Team operations zones in the western section of the BMGR. As many as 500 to 600 archaeological sites determined or recommended eligible for National Register listing are anticipated to be subject to some level of military impact.

Mitigation measures to offset effects to archaeological sites in the western section of the BMGR are spelled out in the existing programmatic agreement for the YTRC in Arizona. Briefly, MCAS Yuma has made a commitment to avoid all known eligible sites by tightening the boundaries of the ground operations areas and instituting educational briefings to ensure that Stinger Teams avoid sites during their pedestrian exercises. They have further committed to developing an inventory strategy for the unsurveyed portions of the ground operations areas and Stinger zones, and to developing and implementing any additional avoidance or data recovery procedures that may be necessary.

Because at least several hundred archaeological sites are known to be subject to impact in the eastern section of the BMGR and about half of the impact zone remains to be inventoried, it is anticipated that a series of priorities for conducting both survey and data recovery will be developed in the ICRMP. The ICRMP will also include and expand on management plans outlined in a cultural resources management plan for the eastern section of the BMGR by the BLM. With regard to additional survey, environmental situations estimated to be of greater sensitivity than others likely will be targeted first. A prioritized listing of sites with varying

degrees of data potential with respect to specific research questions also will need to be developed so that a sampling strategy can be implemented. Avoidance potentials, especially for major sites, also will need to be explored. As an example, a target complex within the South Tactical Range was inactivated in 1997 when it was realized that impacts to a very important and substantial archaeological site were occurring. Further mitigation (for example, limited data recovery) is being considered at this site. Full scale excavation at another substantial site and two smaller sites located proximal to AUX-6 resulted in the recovery of a representative quantity of archaeological information with unrestricted use of AUX-6 permitted thereafter.

Currently, BLM law enforcement officers patrol non-military use zones periodically to discourage vandalism to archaeological sites. Other proactive mitigation measures under current development include (1) archaeological data recovery from selected important archaeological sites exhibiting existing substantive impacts from military training, vandalism, or natural processes; (2) establishment of a database to track threats and disturbances to known sites; and (3) discussions with the SHPO and Tohono O'odham Nation and Hia C-ed O'odham Alliance concerning an extension of the Site Stewards Program to the BMGR. Site stewards are volunteers that periodically inspect threatened sites for evidence of vandalism or other damage. The program would target especially sites at risk from recreationists in non-military use areas. An agreement between the SHPO and Air Force was executed in June 1998 to develop a Site Steward Program for the BMGR with Native American involvement and training as a focus. Sites currently identified as being at risk in these areas include two in the western section of the BMGR; and (as reported in a Cultural Resources Management Plan developed in 1992 by the BLM for the eastern section of the BMGR) (1) an archaeological site with a historical period standing structure, (2) the remains of a historic ranch, and (3) a rock shelter. Sites recently identified as being at risk are a historic mining complex and a historic ranch in Area A; and several as yet unrecorded rock shelters near Hat Mountain in Area B (Masse 1998). Signs to discourage vandalism and restrict unlimited access currently are in-place at one of the sites in the western section of the range; additional signs will be placed at other locations.

In addition to impacts from recreationists, several important sites on the BMGR are being impacted severely by natural erosion. Most notable is sheet washing and cutbank erosion along Growler Wash in the South Tactical Range, and cutbank erosion at a site near AUX-8 along State Route 85 north of Ajo. Mitigative measures for these and other important archaeological sites being affected by natural erosion are to be developed in the ICRMP.

It is possible that application of mitigation measures such as those described here will not be regarded as sufficient to reduce residual impacts to insignificant. This is a possibility because of the sheer volume of archaeological sites included in the impact zones of the three tactical ranges and the need to prioritize survey and data recovery.

Mitigation for World War II Airfields, Other Historic Buildings and Structures, and TCPs

A programmatic agreement currently is being developed for management of all seven airfields determined eligible (or likely to be so determined) under criterion A and the four determined

eligible under D as well. It is proposed that on-going and potential future use of six of the airfields (AUX-2, AUX-7, AUX-9, AUX-10, AUX-11, and Stoval Field) and the incremental natural deterioration to which they are subject be mitigated by preserving AUX-8. The programmatic agreement specifies that a preservation and maintenance plan be developed and implemented along with a public interpretation program.

Historic mining, homesteading, and ranching facilities within the impact zones might be treated in a similar fashion, with a selected sample slated for preservation efforts. Archival research also might be specified as a mitigation measure to offset loss or damage to properties such as these. As stated above, should visual or auditory intrusions upon properties valued for in-place preservation and interpretation in an unaltered setting be identified, mitigation to at least partially offset those effects could be designed. To date, however, such effects have not been positively identified.

Unavoidable impacts to TCPs and sacred sites might be regarded as “unmitigable” by the traditional communities that value them, in which case, significant impacts might be identified. Such a finding could only be made with specific input from the subject communities.

Other Mitigation Measures

In the ICRMP, procedures will be outlined to ensure notification of proposed undertakings by agencies including the ANG, ARNG, AGFD, Drug Enforcement Agency, International Boundary and Water Commission, and U.S. Border Patrol (that is, agencies whose actions have the potential to affect cultural resources on the BMGR, but who lack land management responsibility, or have administrative authority over relatively small areas within the BMGR). Once in place, these procedures should lessen the potential for compliance with cultural resource legislation to “fall through the cracks.”

Procedures to deal with potential impacts from unexpected and unpredictable aircraft crashes throughout the BMGR including the Cabeza Prieta NWR have been developed and agreed to in the existing programmatic agreement for administration of the YTRC (Appendix F). Similar procedures and commitments have been developed by the Air Force and will be further articulated in the ICRMP and its implementing programmatic agreement.

4.7.4 Alternative Action

From a cultural resource perspective, there is little difference between the proposed and alternative actions. It is possible that long-term planning to integrate military objectives with cultural resource management goals might be somewhat more difficult to achieve under the 25-year term than it would be with an indefinite term.

4.7.5 No Action

Threats to cultural resources are sharply reduced in areas such as military reservations because public access (with associated inadvertent and intentional vandalism), while not entirely prohibited, is severely curtailed. This threat reduction would be removed under the no-action alternative. To be sure, federal land managers including the BLM have a responsibility to protect cultural resources on public lands, but realistically, funding to adequately police vast acreage often is unavailable.

Under the no-action alternative, intensive decontamination procedures would be required. These cleanup efforts likely would entail substantially greater ground disturbance than is occurring now during the one-year and five-year EOD sweeps, which are not intended to locate all ordnance. Any decontamination efforts deemed necessary in the Cabeza Prieta NWR would cause ground disturbance throughout areas not surveyed for archaeological sites at present, but where archaeological sites certainly are present. Compliance with historic preservation legislation would be required as an aspect of the decontamination, but the time frames involved likely would necessitate more hurried mitigative strategies than those that could be put in place under the proposed and alternative actions.

4.8 SOCIOECONOMICS

4.8.1 Overview and Significance Criteria

The socioeconomic impact of the BMGR is measured in terms of its current contribution to the social and economic environment of the BMGR region. This contribution is integrated with the overall impact that the training by military installations has on the communities and counties that surround them. A socioeconomic model was used to estimate socioeconomic contribution in terms of direct employment, indirect employment, and expenditures. The model evaluates the contribution of the BMGR as well as the military installations that use the BMGR, to the extent that military mission capabilities are supported by BMGR training opportunities. The results of the socioeconomic model were used to estimate the current impact of the BMGR on the social and economic environment of the study area. The results of this model are also used, to the extent possible, to assess the impacts of the LEIS alternatives. Potential impacts to communities and counties were considered to be significant if alternative actions would likely cause:

- # substantial change to the overall mission of an installation that directly results in employment provision or loss
- # substantial population change through the provision or loss of employment
- # inconsistencies with regional growth management plans

4.8.2 Proposed Action

Under the proposed action, there would be no expected changes to the operation and use of the BMGR. Therefore, military installations with missions supported by the BMGR would continue to operate at current levels for the foreseeable future, and current socioeconomic contributions to communities and counties surrounding the BMGR would continue. As projected by the socioeconomic model described in Section 3.9.5, this would retain a total of more than 17,000 direct jobs in California and Arizona and more than 49,000 indirect jobs as Luke AFB, 162nd ANG, Davis-Monthan AFB, MCAS Yuma, WAATS, and MCAS Miramar would continue to operate at existing levels. Employment translates into wages that are projected to total nearly \$1.8 billion between both direct and indirect jobs. Regional growth management plans anticipate and provide for the continued socioeconomic contribution of the military installations in the study area. No adverse socioeconomic impacts would be expected with implementation of the proposed action.

4.8.3 Alternative Action

In terms of socioeconomic impacts, the differences between implementation of the proposed action and the alternative action would not vary appreciably. However, the indefinite withdrawal of the proposed action might ensure job preservation and allow regional growth management planning beyond the 25-year withdrawal period of the alternative action. The jobs and wages retained with the alternative action would be the same as the proposed action, and no adverse socioeconomic impacts are expected.

4.8.4 No-action Alternative

Under the no-action alternative, military missions capabilities supported by the BMGR could be substantially changed. The LEIS does not attempt to forecast the future decisions that may be made by the various branches of military services and DoD if the BMGR is not renewed. Therefore, although the socioeconomic effect is expected to be negative, the LEIS cannot quantitatively estimate the effects of mission changes at particular installations.

If the range is not renewed, there is a potential for economic gain from future BMGR land uses that may be permitted, such as mining and livestock grazing. Decisions regarding future land use and management of range lands would involve a public review process that includes evaluation of environmental resource impact, including socioeconomics.

Based on the socioeconomic model, the general impacts of non-renewal can be discussed only qualitatively in terms of counties or communities that have the potential to be negatively affected in the event that the BMGR is not renewed.

Communities supporting the BMGR, Luke AFB, 162nd Arizona ANG, MCAS Yuma, WAATS, Davis-Monthan AFB, and MCAS Miramar would all be affected to some degree if the BMGR were not renewed. Substantial changes in the overall installation mission capabilities that would

directly result in the loss of employment would most likely occur at Luke AFB and 162nd Arizona ANG. Adverse socioeconomic impacts would be greatest in the Maricopa County communities surrounding Luke AFB, most notably Litchfield Park, Youngtown, Surprise, Glendale, Phoenix, Avondale, Goodyear, and Peoria. Within Pima County, the community of Tucson would be most severely impacted with lesser impacts to South Tucson. MCAS Yuma is also likely to be impacted, primarily affecting the city of Yuma and the Cocopah Indian

Reservation and surrounding area⁴⁹. Although less likely to occur, loss of employment at other Arizona and California military installations in the study area would also adversely affect the communities surrounding them.

For missions that are moved to other installations, potential losses in employment, earnings, and total revenues would eventually be absorbed through the provision of employment in other regional growing economic sectors. However, current economic dependency in some communities such as Glendale, Peoria, and Goodyear in Maricopa County is expected to increase initial impacts and slow recovery in these communities.

4.8.5 Management Actions

Neither the proposed action nor the alternative action would have adverse socioeconomic effects so no mitigation is necessary.

Implementation of the no-action alternative has the potential to have adverse and significant socioeconomic effects in the communities and counties surrounding (1) the BMGR and (2) installations with an appreciable portion of their mission capabilities reliant on the range. Until the extent to which non-renewal of the range could impact each installation, county, or community can be fully estimated, no measures can be taken to mitigate potential adverse socioeconomic impacts.

4.9 VISUAL RESOURCES

4.9.1 Significance Criteria

The inventory and assessment indicate that the current visual environment of the BMGR is affected by military activities; however, the military modifications are distinctly subordinate elements within the majority of the landscape setting. Although there are no changes currently forecast for range facilities, some assumptions can be made regarding the consequences of continued military use on the visual environment under the renewal alternatives. The challenge in assessing the impacts of the BMGR renewal, however, is assessing the impacts of possible future military or non-military activities that may impact the visual environment. These projections for future military use become increasingly speculative as the forecast distance increases into the future.

Impacts to visual resources were considered significant if implementation of the proposed action, alternatives, or renewal scenarios would potentially result in one or more of the following consequences:

⁴⁹ Because demographic data for the Cocopah Indian Reservation are reported in a census tract that includes the areas surrounding the reservation, the area is referred to as Cocopah Indian Reservation and surrounding area. The tribe was contacted to inquire about any other data that may more accurately represent the demographics of just the reservation; however, no such data were available.

- # modifications or disturbances that would appreciably degrade the visual resources or alter the character of the landscape within the BMGR in regard to scenic quality and sensitive viewpoints (accounting for the military context of the range)
- # modifications or disturbances that would not be in compliance with BLM Visual Resource Management (VRM) classifications for the BMGR

4.9.2 Proposed Action

Under the proposed indefinite renewal of the BMGR, the landscape qualities of the range would continue to be directly impacted by military activities only within established target impact and ground support areas, which constitute a relatively small proportion of the total range land area. The landscape qualities of the portions of the BMGR not directly impacted by military activities would continue to be conserved at a level not afforded to adjacent non-range lands. In addition:

- # Military modifications in existing military use areas such as target facilities, munitions footprints, equipment/instrumentation sites, and administration and support areas could occur. Existing sites would likely be favorable locations for new facilities; however, all such activities would be subject to review and evaluation under NEPA.
- # The continued air-to-ground delivery of HE ordnance would continue to impact the landscape in and around the TAC range HE hills. The footprint of HE impact could conceivably expand as a result of continued bombing; however, continuing developments in weapons delivery technology will also likely improve the abilities of a student pilot to accurately hit the target center.
- # Nearly all range areas would continue to be subjected in some degree by sporadic aircraft overflight uses.
- # Until BLM finalizes the VRM classifications for the range, management under the interim classifications would continue. ACECs, SRMAs, Yuma Desert and Sand Dunes HMA, mountain ranges, El Camino del Diablo and other recreation travel corridors would continue to be managed under Class II VRM objectives. The BMGR manned ranges, tactical ranges, San Cristobal Valley, Baker Peaks ground support complex, and the ISST site would continue to be managed under Class IV VRM objectives. The remaining areas of the range would continue to be managed under Class III VRM objectives.

During the renewal time frame, large portions of the BMGR would continue to be unavailable for public access or available for limited times because of military exercises and facilities. Views of these areas would continue to be of high to moderate sensitivity based on public access and agency concern for the viewpoint. For areas of the BMGR open to public visitation, existing military use modifications would continue to have an impact on the viewer. Because of the

military context of the BMGR, the impacts of these modifications and the visual sensitivity of pertinent viewpoints would be expected to differ from the same impacts in an area with similar landscape characteristics such as Organ Pipe Cactus National Monument. Visitors to the BMGR are made aware of the military presence on the range and are, therefore, likely to have a greater tolerance and even appreciation for the visual disturbances posed by military activities.

Views of the BMGR from highways or other adjacent areas would continue to be most notable along the western boundary of the range. This area may also be subject to an increased visual sensitivity level due to the expansion of the Yuma area. More persons viewing the range would possibly result in a higher level of concern for military modifications to foreground and natural landscape backgrounds within some of these views.

4.9.3 Alternative Action

Impacts to visual resources resulting from a 25-year withdrawal alternative are expected to be similar to those described for the proposed action. Military overflights and other training operations would continue to cause temporary visual intrusions. Military modifications to the range would continue to impact persons who visit in areas open to public access.

4.9.4 No-action Alternative

Under the no-action alternative, BMGR lands would not be renewed and military ground operations would be discontinued. Many of the visual impacts due to military use of the range would be reduced or eliminated. Range deactivation would consist of removing target facilities and decontaminating the lands of hazardous ordnance. These activities may, in the short term, increase the amount of modifications on the range. In the long term, target areas would undergo reclamation and be allowed to recover from military impacts.

If the results of new management planning find that the former range lands should be opened to appropriate land uses or recreation, visual impacts could potentially be greater than those currently resulting from military modifications. These impacts would be evaluated during the BLM planning process for the future use of these lands.

4.9.5 Management Actions

Because there are no potential significant and adverse impacts to visual resources identified for the proposed action, alternative action, or no-action alternative, no mitigation measures or management actions are necessary.

4.10 RECREATION

4.10.1 Introduction and Significance Criteria

The impact assessment and mitigation planning process for recreational resources involves assessing impacts based principally on a comparison of the proposed range renewal versus not renewing the range, in which case the lands would revert to the BLM's primary jurisdiction. To predict potential impacts, three basic assessment variables are considered: (1) resource sensitivity, (2) resource quantity, and (3) resource quality. The combination of the three assessment variables will determine initial levels of impact, which may then be reduced using appropriate mitigation measures. For the recreation resource, much of this analysis is qualitative, due to the nature of the LEIS.

To aid in the comparison of alternatives, the following impact levels were assigned, where appropriate. Impact level assignments are:

- # *High* Impacts that would be considered significant as described above, and where the action would result in substantial adverse change or stress to the recreation resource.
- # *Moderate* Impacts that would potentially result in substantial adverse change or stress to the recreation resource.
- # *Low* Impacts that would result in minimal sensitivity and where resource quantity and quality are affected minimally.
- # *No identifiable impact* Impacts where no measurable change would occur.

Impacts to recreation are generally considered significant if a designated federal, state, regional, or local park or preservation or recreation area is: (1) affected such that the amount of land available for recreation is reduced or increased, and/or (2) the inherent value of that use is diminished or enhanced for the long term.

The military context of the BMGR is directly relevant to determining the significance of impacts to recreation. The BMGR is characterized by a mosaic of lands that provide direct or indirect support to military training. Many of these areas are not regarded as recreation use areas and are closed to recreational use on a continuous basis to protect public safety and prevent interference with training schedules.

4.10.2 Proposed Action

Under the proposed indefinite renewal of the BMGR, the foreseeable future of the recreation environment would be similar to the existing range conditions. In summary, this projection means that:

- # The underlying biological, cultural, and landscape qualities of the range that support recreation would continue to be directly impacted by military activities only within

established target impact and ground support areas, which constitute a relatively small (less than five percent) proportion of the total range land area.

- # Nearly all range areas would continue to be subjected to some degree to sporadic aircraft overflight noise.
- # The biological, cultural, and landscape qualities of range areas not directly impacted by military surface impacts would continue to be conserved at a level not afforded to adjacent non-range lands on a scale anywhere near as expansive.
- # The ACECs, SRMAs, and the HMA located within the range would continue to have a high level of environmental preservation.
- # The degree of recreation access to various range areas now enjoyed by the public would likely continue unimpeded.
- # Recreation access to target ranges and other high hazard areas would continue to be severely restricted to protect public safety and prevent disruption of training missions.

As long as DoD continues military training on the BMGR large portions of the range would continue to be unavailable or limited for recreational use because of military exercises and facilities, including the majority of the eastern section of the range and the westernmost portion of the western section of the range.

Recreation on the range would continue to most frequently occur in Air Force Management Areas A, B, C, and D on the eastern section of the range; Cabeza Prieta NWR; and the majority of the western section of the range located east of the Moving Sands/Cactus West target area, including El Camino del Diablo.

Over the next 15 years, it is assumed that existing target and training areas will remain in place and the ground and airspace use will not drastically change. Opportunities for recreation on the BMGR, therefore, are expected to continue. In addition, the types of recreation are not expected to change substantially from that which occurs presently. The overall number of those participating in recreational activities is expected to increase as a result of increases in the overall population adjacent to and within reasonable driving distance of the BMGR. This increased recreational demand, however, is not expected to be substantial, and would likely cause relatively little change in recreation visitation to the range.

In general, the primary impacts of the indefinite withdrawal alternative on recreation resources include continued limitations on access to recreational resources within the range, and aircraft noise and visual effects to recreational users of the range. Moderate impacts would result from major, relatively undisturbed portions of the range being restricted to public access because of military activities. Portions of these restricted areas include outstanding natural and cultural features that would continue to be unavailable to the public.

Low to moderate impacts to range visitors would result from noise and visual intrusions on the recreation experience from aircraft, military vehicles, or electronic telemetry stations. A determination of what constitutes unacceptable noise and visual impacts varies because of the range of desires and values of recreationists, the subjective nature of the response to noise and disruption to views, and the nature of the recreation opportunity. Visitors wanting to experience solitude and the primitive attributes of the desert, for example, would be more likely to be affected by noise and disruption to views. The types of recreation that take place on the BMGR, as well as awareness by recreationists of the military presence, is likely to result in a greater tolerance of the sounds and sights of aircraft overflight and other training activities.

Continued withdrawal of the BMGR would not likely change recreation patterns or visitation of recreation facilities in the vicinity of the range. In general, the opportunities for recreation and the quality of the recreational experience on lands adjacent to the BMGR would remain unchanged from existing conditions.

4.10.3 Alternative Action

Impacts to recreation resources resulting from a 25-year withdrawal alternative are expected to be similar to those described for the proposed action. Like the indefinite withdrawal alternative, impacts to recreation as a result of implementing this alternative would include continued limitations on access to recreational resources within the range, and periodic aircraft noise and visual intrusions to recreational users of the range.

The forecast for the range future over a withdrawal period of 25 years must be regarded as increasingly speculative beyond 10 to 15 years. The prediction of new military training activities that may affect recreation are uncertain, as are forecasts of the types of recreation that may be popular in 25 years. Overall recreation demand for the BMGR would likely increase as a result of increasing population in the vicinity of the range, but this increase cannot be quantified with any certainty.

4.10.4 No-action Alternative

Under the no-action alternative, the existing land withdrawal and reservation of the BMGR would terminate and military use of the withdrawn land under P.L. 99-606 would end. The lands within the existing BMGR withdrawal would be managed by the BLM and USFWS under existing authorities. The Air Force would continue to have jurisdiction over 2,675 acres of former privately owned land and 81,121 acres of former Arizona state trust lands which were purchased by the Air Force. Assuming that Congress takes no other action to redefine the non-military administration and the affected lands, the BLM-administered public lands would be subject to the multiple resource management objectives of FLPMA. Surface management of the Cabeza Prieta NWR would continue to reside with the USFWS.

In the foreseeable future, recreation management of the lands within the range would likely remain relatively unchanged. Public Law 99-606 requires the DOI, in consultation with the Secretary of the Air Force, to determine the suitability of BMGR lands for other land uses if the range is not renewed. Specifically, the consultation would determine if decontamination of the land is practicable and economically feasible and what residual public health and safety risks may be present. This determination must be made in consideration of the potential future use and value of the land and would require additional NEPA documentation. Assuming that major portions of the range are free of contamination, the BLM would then likely develop a new RMP for the range, in accordance with an established public planning process.

Until these activities take place, existing resource conservation and protection areas, including the ACECs, SRMAs, HMA, and El Camino del Diablo as a Backcountry Byway, would likely be maintained by the BLM. Several of these areas, including the Sentinel Plains Lava Flow SRMA and the Crater Range SRMA, would no longer need to be restricted for public access during military operations because such operations would be discontinued.

It is assumed that existing recreation management of the range would continue. The guidelines for the use of these lands would be based on information about recreation resources in the BLM Lower Gila South RMP Goldwater Amendment. Many of the proposed management actions identified in the Goldwater Amendment deal with how the BLM and the military will work together to manage the recreational resources on the range. With the removal of the military withdrawal, many of the proposed management actions would no longer be necessary. Management actions described in Section 3.11 would likely continue.

Recreational opportunities on the Cabeza Prieta NWR would be unlikely to change and would continue as they are under current or pending USFWS management guidelines. Recreational activities would likely continue to include backpacking and hiking, vehicular and non-vehicular camping, picnicking, hunting, photographing and observing wildlife, and mountain biking. The opportunity for solitude associated with wilderness may increase if low-level overflights over the refuge are reduced or eliminated because ground support of air operations would no longer be allowed. Noise impacts and visual intrusions from military training activities would likely be reduced or eliminated as a result of this alternative.

In the long term, not renewing the BMGR could maximize recreational opportunities and access to recreational activities on the federally managed lands. Existing recreational activities would likely continue to take place. All types of recreation would likely see an increase in use due to increased access and increasing population within the region. The new access would help to meet the needs of the growing population in the area for outdoor recreation. Implementing the no-action alternative would most likely lead to increased visitation of the public lands for the purposes of viewing and experiencing a large expanse of relatively undisturbed desert.

Recreation resources in the vicinity of the BMGR would be virtually unchanged from current conditions as a result of implementing this alternative. In the short term, existing recreational activities would continue to take place at about the same participation level as is found currently. In the long term, recreation use adjacent to the range may decrease slightly as a result of having

additional recreational facilities available; this decrease, however, would likely be offset by increases in recreation demand.

4.10.5 Management Actions

Proposed Action

Primary impacts to the recreation resource are as a result of continued limitation on access to recreational resources of the range, and the effects of noise to recreational users seeking solitude within the range. These impacts are considered to be minimal, however, given the amount of recreational opportunities available in the vicinity of the range and the relative infrequency of overflights of the Cabeza Prieta Wilderness, an area where solitude might be expected. As a result, no mitigation is required.

Alternative Action

Like the proposed action, the alternative action would have low to moderate impacts on the recreation resources and recreational users of the range, and mitigation is not required.

No-action Alternative

Implementing the no-action alternative could result in substantial changes to recreational use within the existing BMGR boundaries. Removing the land restrictions and opening up the range for various public uses allowable within federal management guidelines could cause increased pressures on the resources on BMGR lands within the framework of multiple-use management. This alternative could maximize recreational opportunities and access to recreational activities on the federally managed lands. Mitigation to reduce potential impacts would include a thorough evaluation of the costs, benefits, and environmental consequences of competing land uses through planning directed by FLPMA and reported in NEPA documentation.

4.11 HAZARDOUS MATERIALS AND WASTE

4.11.1 Proposed Action

Hazardous and Toxic Materials

Under the proposed action, personnel would perform routine activities and continue to generate hazardous and toxic materials at current levels. Use of hazardous materials is not expected to increase in relation to future range uses. In fact, there has been a decrease of hazardous materials use on the BMGR in recent history. Sources of hazardous and toxic materials would continue to include munitions and ordnance debris at manned and tactical ranges; septic fields; petroleum

storage tanks; electrical transformers (except dry type); and facility operation shops such as aircraft and vehicle maintenance areas. These sites have generated hazardous materials including POLs, paint thinner, cleaning solvents, pesticides, herbicides, and ordnance. Air Force and Marine Corps policies that aim to effectively promote pollution prevention by minimizing or eliminating the use of hazardous materials and the release of pollution into the environment, and to meet or exceed regulatory requirements would remain in effect.

Spill prevention procedures that are currently in use would remain under the proposed action. Hazardous materials would continue to be removed from vehicles or aircraft before placing them in target simulations such as vehicle convoys on the TAC ranges, applied tactics targets on the Manned Ranges, and aircraft on the TACTS range. Precautions taken during field training exercises to avoid spills of hazardous substances would continue. Fuel tankers, vehicles being fueled, and generators, all of which are potential sources for release of hazardous substances, would continue to be placed over temporary containment aprons to catch inadvertent spills. Similar precautions would be taken at other sites with potential for release of hazardous substances. Additionally, a hazardous materials response plan and team is in place on both the eastern and western sections of the BMGR to respond to spills.

Hazardous Waste Management

The proposed action would not result in changes to the current level of hazardous waste generation, and therefore, would require no additional management commitment. Current programs that are designed to control hazards to human health, welfare, and the environment and assure compliance with federal, state, and local statutes and regulations would be continued. These rules and regulations would sufficiently guide waste management in the foreseeable future. Adjustments and updates to current procedures would be made as required for increases or decreases in hazardous waste generation and/or waste accumulation point sources. Hazardous waste investigation and remediation sites would continue to be monitored by military personnel as well as state and federal agencies in accordance with all applicable state, federal, and local regulations. Aboveground and underground storage tanks would be upgraded as needed.

Solid Waste

The accumulation of solid waste would continue at current levels. Non-hazardous solid waste collection and disposal procedures that are in use today would remain in use, and are expected to be adequate for future solid waste requirements. Solid waste generated during deployment training exercises on the BMGR, such as the Marine Corps semi-annual WTI course, would continue to be properly contained. At the Marine Corps ground support areas where ground troops bivouac, sewage would continue to be contained in portable on-site toilets that would be removed by a commercial contractor on a regular basis. Litter generated by troop activities would be monitored and contained daily to be transported off the range to established, authorized landfill sites. Adjustments to future increases or decreases in solid waste generation would be made as needed.

4.11.2 Alternative Action

The environmental consequences from hazardous and toxic materials as well as hazardous and solid waste would be the same under this alternative as they would be under the proposed alternative.

4.11.3 No-action Alternative

Hazardous and Toxic Materials

Subject to the no-action alternative, hazardous and toxic materials would no longer be used on the BMGR by military personnel, their contractors, or other military-related units or organizations. Activities at established aircraft and vehicle maintenance facilities, at ground target locations, and at other remote sites such as ground support areas and electronic equipment locations, would cease. Ordnance would no longer be delivered to ground targets. Known hazardous waste existing on the BMGR would be removed and transported to an approved site. Military hazardous materials and spill response teams would remain prepared to respond until the range would be turned over to the Department of the Interior.

Hazardous Waste Management

Under this alternative, hazardous waste would not be generated as they are now from existing military operations. Hazardous waste associated with this alternative would be limited to waste that may be created in the process of range deactivation. For example, demolition of military structures on the range may result in inadvertent spills of waste petroleum products such as raw fuel from demolition equipment. Additional petroleum product release could occur during removal of underground or aboveground fuel storage tanks. These tanks are located in high use areas that would be easily accessible by spill response teams. Significant quantities of hazardous waste in the form of materials containing asbestos or lead based paints may be encountered before and during demolition of buildings on the BMGR. Smaller quantities of commonly used chemicals including pesticides, paint thinners, and cleaning solvents, are potentially hazardous wastes that are likely in abandoned buildings and may accumulate as demolition proceeds. Established procedures for proper demolition and handling of hazardous and toxic wastes, set forth by the EPA, would be followed during deactivation of the BMGR. Monitoring by the Environmental Flight at the 56th FW, Luke AFB for the Air Force section of the range and the MCAS Yuma Environmental Department for the Marine Corps section of the range would occur during range deactivation.

As specified in P.L. 99-606, clean up and closure of any hazardous waste sites identified on the BMGR would be determined during non-renewal consultations between the Secretary of the Interior and the Secretary of the Air Force.

It would be necessary to determine if decontamination of explosive, toxic, or other hazardous materials on the BMGR is needed, practicable, and economically feasible. Depending on the proposed decontamination method, it would also be necessary to evaluate the environmental impacts associated with proposed decontamination. For example, if a determination is made that decontamination will involve ground disturbing subsurface removal of ordnance, there would be possible impacts to biological or cultural resources that would need to be evaluated.

Section 7 (b) of P.L. 99-606 requires the Air Force to submit a description of the BMGR decontamination efforts taken during the previous fiscal year and the decontamination activities proposed for the next year including an estimate of the costs for full decontamination of the BMGR and the estimate of the time to complete such decontamination. The most recent report filed by Luke AFB estimates a cost of \$136 billion and a time period of 20 years to complete (surface and subsurface) decontamination of the eastern section of the range and the Cabeza Prieta NWR (U.S. DoD, Department of the Air Force 1995). An additional cost of \$56 billion is estimated for decontamination of the western section of the range (Pearce 1997).

Solid Waste

Solid waste generated by military personnel would cease after completing range deactivation, although a relatively small amount could be generated during these activities. Practices during range deactivation would be consistent with current management of solid waste and would eliminate risk of hazards to human health.

4.11.4 Management Actions

No significant and adverse impacts are expected with implementation of the proposed action, alternative action, or no-action alternative. Thus, no mitigation measures are necessary for hazardous materials and hazardous waste. Ongoing programs that address environmental management of hazardous materials and waste would continue and include:

- # a recently implemented education program to increase awareness about the proper transportation, handling, use, and disposal of hazardous materials and hazardous wastes and methods for pollution prevention
- # efforts to reduce or eliminate the use of hazardous materials and waste generation
- # implementation of spill prevention, control, and countermeasures
- # trained Air Force and Marine Corps emergency response teams available to respond to releases of hazardous materials on the range

4.12 EARTH RESOURCES

4.12.1 Proposed Action

The proposed action to renew the BMGR would subject earth resources to the effects and potential effects of a continuing land withdrawal and continuing military activities. Briefly, these effects would include:

- # continued segregation of BMGR lands from entry under the mining and mineral leasing laws, which would preclude exploration for and development of any mineral or energy resources for the duration of the withdrawal
- # continued segregation of BMGR lands from other forms of appropriative land use, such as livestock grazing or developed agriculture, which would prevent potential widespread disruption of earth resources from such uses for at least the duration of the renewal period
- # continued physical disturbance of land surfaces used for military purposes by on- and off-road vehicle use; the impact of inert and live ordnance; maintenance or construction of roads, targets, or other military facilities; and field deployments of troops and equipment
- # continued potential for earth resources in selected range areas to be rendered either difficult or impossible to access for future development because of expended but unexploded ordnance located on or beneath the ground surface
- # continued potential for soil contamination from fuels, lubricants, coolants, hydraulic fluids, or other fluids spilled from military vehicles, generators, aircraft, or other equipment, or explosives/propellants leaked from expended but unexploded ordnance (this issue is addressed in Section 4.11)

Effects of Continued Segregation

Renewal of the BMGR would continue the land withdrawal restrictions on development of (1) potential mineral and energy resources that are known to or may occur within the BMGR and (2) other forms of appropriative land use for the duration of the renewal. Renewal of the range would not preclude potential future development of mineral and energy resources or other appropriative land use potentials following a future expiration of the range withdrawal. New management planning for the expired range would have to be completed, however, before any of the affected lands could be opened for any form of appropriative land use. Former BMGR lands within the Cabeza Prieta NWR would not become available for future development because they are closed to appropriative land use under separate statute (Arizona Desert Wilderness Act of 1990, P.L. 101-628). The impact of the range renewal on mineral or energy resources or other earth resources that may be affected by other excluded forms of appropriative land use is considered to be low because the military land withdrawal will hold earth resources in reserve without precluding potential future use of those resources.

Effects of Physical Surface Disturbance

Renewal of the BMGR would result in continued military activities, some which would require direct use and physical disturbance of selected range land areas. The pattern of military surface use during the renewal period is projected to be little changed from current use. Surface disturbing activities would include on- and off-road vehicle use, inert and live ordnance impacts, maintenance or construction of targets or other military facilities, road maintenance or construction, and field deployments of troops and equipment. Collectively, these activities currently utilize about 10.1 percent of the range surface, or about 270,000 acres.⁵⁰ An additional almost 87,000 acres is held in reserve for potential future use as a formerly active but now inactive air-to-air firing range (see Table 3-6, line 2, and Figure 1-2).

The existing 270,000-acre area and the 87,000-acre inactive but reserved air-to-air firing range are projected to be sufficient to support foreseeable military activities during the proposed range renewal period. Future physical disturbances of range land surfaces resulting from military activities would be concentrated within these existing areas as are existing operations (see Figures 1-2, 3-3, 3-4, and 3-5).

The degree of disturbance caused by operations can vary widely among the different types of military surface use areas and can also vary significantly with location within individual use areas. The degree to which soils or vegetation communities are disrupted by the various surface uses has consequently been rated to provide a measure of the physical effects of military activities on earth and other resources (see Table 3-6). The results show that:

- # The almost 3.8 percent of the BMGR underlying the primary air-to-air gunnery range is affected by a negligible to low level of surface disturbance resulting from the widely dispersed impacts of expended inert 20 mm cannon rounds and expended aerial tow targets. An additional approximately 3.2 percent of the range surface underlying the inactive alternate air-to-air gunnery range has been similarly affected, raising the total area potentially subject to such effects to just over 7.0 percent of the range surface.
- # Disturbance from military activities occurs within approximately 4.8 percent of the range as a result of EOD operations.
- # Less than 2.0 percent of the range surface is used for activities that cause up to high levels of surface disturbance or result in a complete disruption of the original soil surface or vegetation community in core use areas or at developed use sites (see Table 3-6, lines 6 to 23). Physical surface disturbance within a major portion of this acreage away from the core use and development areas is rated at only a low to moderate level.

⁵⁰ 10.1 percent equals 270,186 acres of active direct surface use out of 2,668,100 acres in the BMGR. These 270,186 acres of surface use are derived from the total military surface use figure shown in Table 3-6 minus the acres listed on lines 2, 12, 14, and 23, which are locations that are no longer actively used for military operation, and those acres listed on lines 6 and 7, which are accounted for in line 8.

The foreseeable projections of how a renewed BMGR would be used to support continuing military activities indicate that the patterns and levels of surface disturbance described above would generally continue within the same military surface use areas. An identified exception is the pending Marine Corps proposal to extend its current surface use authority from 19.6 square miles up to about 34 square miles within the western section (addressed in the YTRC EIS, U.S. DoD, MCAS Yuma 1997). The additional 9,216 acres, or 0.35 percent of the range surface, would be used principally for various ground troop deployment areas (see Figure 1-2). Full implementation of this proposal would subject the affected area to the low to high disturbance effects of troop and equipment deployments. The effects of such deployments would not be uniformly distributed over the 9,216 acres. Rather, troops and their equipment would tend to be concentrated within subsections of the approved use areas as is the current practice.

Nearly all of the military surface use areas are located within the broad alluvial valleys of the BMGR (see Figure 1-2). The soils within these areas characteristically belong to the Torrifluvents Association; Tremont-Collidge, Mohall Association; or Superstition-Rositas Association. These associations all have either moderate water erosion hazard potential or moderate to severe wind erosion hazard potential as determined by the Natural Resources Conservation Service (NRCS) for soil susceptibility to accelerated erosion when disturbed.

In fact, some ground support areas in the western section and some developed target areas and core impact and EOD clearance areas 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." These 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.

Small portions of the BMGR have cryptobiotic soilsXprimarily consisting of cyanobacteria along with algae, lichens, mosses, fungi, and bacteriaXthat form a thin crust on sandy soils. This fragile crust protects the underlying soil from erosion, absorbs water, and sustains the biologic ecosystem. When cryptobiotic soils are disturbed by activities such as heavy foot traffic or vehicle traffic, the fiber connections are broken both in living and abandoned sheath material. These soils may take more than a decade to re-establish because ample moisture (which may not be available in desert dry spells) is needed for the living filaments to repair and restablize. Also, the cryptobiotic soils on the BMGR consist primarily of various algae and typically occur in the fine grained soils of the alluvial basins and are generally associated with creosote bush. Although these cryptobiotic soils may occur on the range, they are not known to be widespread. Because physical ground disturbance from military operations is limited to about 13 percent of the entire range, and more than half of that acreage is subject to only negligible disturbance, the effects on cryptobiotic soils are minimal, if any.

Accelerated erosion has occurred in association with some 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 existing roads system on the BMGR is regarded as sufficient to support foreseeable military requirements during the proposed range renewal period. Therefore, renewal of the range would not portend a new construction requirement for military roads.

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. This practice would be continued into the proposed range renewal period, which would keep additional surface disturbance to a minimum.

Effects of Unexploded Ordnance Contamination

The potential presence of undetected ordnance that still contain live explosives either on or below the BMGR ground surface could be an impediment to the possible development of mineral, energy, or other earth resources following a future expiration of the range withdrawal and reservation. Examples of dangerous munitions that may be present on the range are: full-scale high explosives-filled bombs or air-to-ground rockets that failed to explode; air-to-air missiles or rockets that also failed to explode; inert full-scale or subscale practice bombs with unexploded signal cartridges; missiles or rockets of any type that retain unburned rocket motor propellant (fuel); or unfired aircraft cannon or machine gun rounds. Unexploded live bombs, which have great destructive potential, are the most dangerous expended ordnance on the range, but any of the above munitions could be hazardous to development operations, such as mining or agriculture, that require disturbance of the ground surface or subsurface.

Although nearly all locations within the BMGR would have to be regarded as suspect for contamination with hazardous munitions following a future expiration of the range, relative potentials for hazardous contamination within various range areas can be approximated according to the historic patterns of munitions use. The three BMGR areas with the greatest potentials for contamination with expended ordnance include the North, South, and East TAC ranges. The manned ranges, Moving Sands/Cactus West Target Complex, formerly used targets such as Rakish Litter and Panel Stager, and the air-to-air firing range also have high potentials for contamination with expended ordnance.

4.12.2 Alternative Action

The effects of the alternative action on earth resources would be the same as those described for the proposed action.

4.12.3 No-action Alternative

The effects on earth resources of not renewing the BMGR, as prescribed by the no-action alternative, would include:

- # the potential reopening of some or all BMGR lands outside of the Cabeza Prieta NWR for mineral or energy development or for other forms of appropriative land use
- # cessation of physical land disturbance by most or all military activities including on- and off-road vehicle use; inert and live ordnance delivery; construction of targets, roads, or other facilities; and field deployments of troop and equipment
- # a potential increase in physical land disturbance from non-appropriative land uses such as recreation
- # cessation of contamination of the range with expended but unexploded ordnance and the likely continuation of EOD work

Potential Reopening of BMGR Lands

The BMGR would not be renewed under the no-action alternative. Non-renewal of the BMGR would raise the potential that some range lands could be reopened for entry under the mining and mineral leasing laws and other public land laws as explained below. Reopening these lands would make development of earth resources possible subject to the findings of federal planning and environmental assessment processes.

Following non-renewal of the BMGR withdrawal and reservation, the BLM would assume full jurisdiction over the remaining federal public lands outside of the Cabeza Prieta NWR with the exception of former state and private lands purchased by the Air Force. The BLM lands would be managed pursuant to the Federal Land Policy and Management Act of 1976 (FLPMA, P.L. 94-579) and other applicable laws and regulations.

Management of these former range lands would continue to be directed by the Lower Gila South RMP Goldwater Amendment until new management planning under FLPMA and NEPA regulations could be completed. Although withdrawal of these lands under P.L. 99-606 from all forms of appropriative land use (such as mining, geothermal leasing, or livestock grazing) would expire, segregation of these lands from appropriative land uses would continue until the Secretary of the Interior could publish an order opening the lands for such uses. An opening order could not be issued by the Secretary until the costs, benefits, and environmental consequences of competing land use could be fully evaluated through planning directed by FLPMA and reported in NEPA documentation. Among the forms of land use that would have to be considered would be appropriative and non-appropriative uses. The results of new land management planning may or may not find that portions or all of the former BMGR lands

managed by the BLM should be opened to some or all forms of appropriative land use. Those areas with known or with a moderate to high potential for particular mineral and energy resources (refer to Table 3-25 and Figure 3-26) would be expected to be of primary interest for development of mineral or energy resources, depending on economic value and demand at the time.

The Air Force would continue to have jurisdiction over 2,675 acres of former privately owned land and 81,121 acres of former Arizona State Trust lands, which were purchased by the Air Force. The Air Force would likely have no continuing military need for these scattered parcels following non-renewal of the BMGR and would probably initiate action to declare the affected lands as excess. The potential reopening of these lands for appropriative land uses would have to await the outcome of the excess property disposal process and any necessary federal planning and environmental review processes.

The Cabeza Prieta NWR would not be opened to entry under the mining laws or most other forms of appropriation under the public land laws because these uses are excluded by the Arizona Desert Wilderness Act of 1990 (P.L. 101-628).

Physical Land Disturbance

Non-renewal of the BMGR would end most or all physical disturbance of range lands associated with the use of munitions, vehicles, or other equipment employed in support of military training or test activities. Limited military surface activities requiring the use of vehicles or other ground-based equipment might continue following expiration of the range if the activities are needed to support continuing military use of the overlying airspace. Continuing military use of the former range lands would have to be approved through appropriate levels of federal land use planning and environmental review.

The extent to which non-renewal of the BMGR would lead to new non-military land uses cannot be determined without the benefit of new land management planning. In any event, the physical and other effects of the resulting new land uses on earth resources would likely differ from those that would occur if the range is renewed. If non-renewal would lead to land uses that emphasize or favor environmental conservation more than the current pattern of military use, the overall effect could be a reduction in impacts on earth resources. Conversely, non-renewal could lead to a mix of land uses, including economic developments associated with appropriative land use, that cause more severe and/or widespread impacts to earth resources than would a continuing pattern of military use. The potential environmental effects of proposed new land uses would be fully assessed in the new environmental documentation prepared in tandem with the new land management plan.

Unexploded Ordnance

Non-renewal of the range would require that all use of ordnance in military training or test activities be ended. This requirement would prevent any further accumulation of expended

munitions on or below the range surface, which in contrast to the renewal alternatives, would lessen the volume of undetected ordnance contamination that may interfere with future earth resource developments such as mineral or energy extraction or conversion to crop lands.

Non-renewal of the BMGR would trigger actions, specified by P.L. 99-606, pertaining to the potential contamination of the range by expended or other materials that could affect earth resources. Specifically, if the Secretary of the Interior does not accept jurisdiction over some or all of the non-renewed BMGR lands because of contamination, then the Secretary of the Air Force must take appropriate steps to warn the public about the contaminated status of the subject properties and the risks associated with entering those lands. Ordnance contamination in some locations may preclude potential earth resource development. The need for ongoing EOD efforts to decontaminate portions of the range would cause some additional surface disturbance of affected range areas.

4.12.4 Management Actions

Renewing the BMGR would continue the withdrawal of range lands from entry for all forms of appropriate land use. Because of this, mineral and geothermal resources would continue to be precluded from development for the duration of the military withdrawal. In the short term, these resources would not be available for use nor would mining companies be able to profit economically from the development of these resources; these short-term effects cannot be mitigated. However, the land withdrawal would not consume these resources so there is no effect in the long term and no mitigation would be necessary.

The potential effects of military use of the range on earth resources is minimized by ongoing management practices, which include containing and remediating the effects of aircraft crashes and preventing, containing, and cleaning up spills of hazardous or toxic materials. In addition, EOD teams periodically clear target areas of inert ordnance debris and detonate unexploded live ordnance and misfired spotting charges on inert ordnance. This practice reduces the amount of ordnance contamination on the BMGR. Potentially hazardous constituents contained in some ordnance are consumed upon detonation. Such management practices would be continued with renewal of the BMGR.

Non-renewal of the BMGR under the no-action alternative would prompt development of specific plans to decontaminate the range, restore disturbed surfaces, and accomplish other required remediation. Continuing EOD work in specified former target areas would reduce the presence of expended munitions on the range. In consultation with the BLM, the DoD would stabilize soil surfaces at former military use sites where determined necessary to promote restoration success. Other types of remediation may be implemented on a site by site basis through consultation with the BLM and other regulatory agencies. Such actions would be expected to benefit earth resources by minimizing the potential for soil contamination and minimizing the potential for soil erosion.

The no-action alternative could make these federal lands available for appropriative use (such as mining, geothermal leasing, livestock grazing) and/or increase non-appropriative use (including recreation). Some of these uses could potentially adversely affect earth resources through increases in surface disturbing activities. The future use of non-renewed lands would be subject to a public planning process and accompanied by NEPA documentation. Specific effects on earth resources would be addressed in that documentation.

4.13 WATER RESOURCES

4.13.1 Proposed Action

The proposed action to renew the BMGR would subject water resources to the effects of a continuing land withdrawal and continuing military activities. In brief, these effects would include:

- # a continuing moratorium for at least the duration of the BMGR withdrawal on potential requirements for developing surface water or groundwater to support appropriative land uses on the range
- # continuing potentials for increased sedimentation of off-range downstream surface water because of elevated soil erosion, particularly from those areas where soils have high or severe erosion hazards, caused by military activities that disturb land surfaces
- # continuing potentials that surface water or groundwater may be subject to contamination as a result of military activities
- # continued use of groundwater for military purposes
- # continuing use of surface water and groundwater to support military activities and for wildlife management purposes

Effects of Continued Segregation

Renewal of the BMGR would preclude the introduction of appropriative land uses within the eastern and western range sections for at least the duration of the land withdrawal. As a result, the potential for water developments that are typically associated with various appropriative land uses such as surface impoundments or wells that might be required to support livestock grazing, mining, or agricultural activities would also be precluded for at least the duration of the range withdrawal.

The continued withdrawal and reservation of the BMGR would not preclude potential surface water or groundwater developments to support non-appropriative land use activities that are authorized under the terms of the range renewal. For example, federal agencies may continue to develop surface water or groundwater at selected areas to meet management objectives. Other

developments may be necessary to meet the requirements of future military missions or those of non-military agencies. All such developments would be subject to the laws and regulations of the State of Arizona governing the water use permitting process. Applicable environmental documentation would also be prepared to address proposed future water developments.

Effects of Physical Surface Disturbance

BMGR lands that are subject to activities that physically disrupt the ground surface show an increased vulnerability to the effects of soil erosion caused by surface water runoff. Some soils, because of their physical/chemical characteristics, are more susceptible to increased erosion when disturbed. These soils have been identified by the Natural Resources Conservation Service (NRCS) as having high to severe erosion hazards. Highly disturbed soils are particularly prone to loss as natural barriers to erosion such as desert pavements, cryptobiotic crusts, or vegetative cover are broken down, rendering the soil material to detachment and removal by flowing runoff.

Once in suspension, sediment can degrade the physical, chemical, or biological quality of surface water. This potential has not been an important issue on the BMGR, however, because of the almost complete lack of perennial or seasonal surface water that may be affected by runoff from military use areas. The one exception is the Baker Tanks, a series of large natural bedrock catchments that hold enough seasonally intermittent runoff to provide water for wildlife year round during all but extended periods of drought. The Baker Tanks, located just west of the Baker Peaks, are downstream of existing Marine Corps ground support areas (see Figure 3-5).

Waterborne sediment from the BMGR could affect receiving waters off-range during those rare precipitation periods when sufficient storm water runoff is generated to reach off-range surface water. Most of the BMGR, and nearly all military ground use areas, drain to the north and empty into the Gila River. Flow within the reaches of the Gila River affected by runoff from the range is controlled by Painted Rocks Dam and Reservoir. Painted Rocks Reservoir and especially the Gila River below the reservoir are often dry because of water storage in upstream reservoirs or water diversions. The first downstream perennial surface water that may be affected by BMGR runoff via the Gila River is the final reach of that river immediately above its confluence with the Colorado River. This segment of the Gila River often flows because of irrigation return from agricultural fields. The affected perennial reach of the Colorado River lies between the Laguna and Morelos diversion dams.

Military ground use areas within the western BMGR, such as AUX-2 and Moving Sands and Cactus West targets, drain westward directly into the Colorado River.

Military use of the BMGR has not been and would not be expected to become an important factor causing increased sedimentation of perennial off-range surface waters for several reasons. First, as explained in Sections 4.12 and 4.12.1, few ground surfaces on the range have been or would be rendered vulnerable to accelerated water erosion by military use. In brief, continuing military use, in addition to past and current use, are forecasted to physically affect no more than

approximately 15.5 percent of the range surface. Those effects, however, are not and would not be uniform. Less than 2 percent of the range is rated as supporting military use that causes moderate to high levels of surface disturbance; about 4.8 percent of the range supports military activities that cause low to moderate levels of surface disturbance. The remaining range surface affected by military activities is located beneath the alternate air-to-air firing range (approximately 3.2 percent of the BMGR surface area) overlying the Cabeza Prieta NWR and below the primary air-to-air firing range (approximately 3.8 percent of the range surface). Fall out of munitions and target debris from these aerial firing ranges has caused widely dispersed but negligible disturbance of the underlying ground surface. Continued use of either the primary or alternate firing range would not appreciably increase the level of disturbance to the underlying lands. The alternate firing range is currently in an inactive reserve status.

Second, because of the low slopes found on most of the range and the typically very high infiltration and percolation capacities of the alluvial soils and drainages, only storms or a series of storms of high intensity and long duration generate surface runoff that flows for any appreciable distance. Only the very largest storm events may generate the volume of runoff necessary to produce flows that can cross the many tens of surface drainage miles that lie between most military surface use areas and downstream perennial waters. Such storms are also likely to generate significant surface runoff and sediment loads from non-range lands, many of which are developed as crop lands, along the Gila River. The increased contribution of sedimentation from military surface use areas is likely to be greatly exceeded by sediment loads generated from runoff from non-range lands.

Third, the berms on which the railroad, interstate highway, and canals along the northern boundary of the range are built have effectively created surface flow detention basins that can retard flows from many of the major drainages of the range. The flow capacities of culverts that provide drainage outlets through these berms can be exceeded by the largest runoff events. In these cases, surface water runoff is temporarily detained behind the berms causing it to reduce its velocity and deposit most of its suspended sediment load. This sediment is thus prevented from being carried further downstream into the lower Gila and Colorado rivers. The San Cristobal Wash, which drains most of the lands underlying the R-2301E airspace, is the prime example of a major drainage on the range affected by the railroad and interstate highway.

Water Quality Contamination Effects

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 by the Marine Corps. 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. The Marine Corps places temporary spill containment aprons composed of thick plastic sheeting over sand bag berms beneath its parked vehicles, generators, or other equipment that may leak toxic or hazardous fluids such as fuel, oil, and hydraulic fluid. The aprons that catch leaks or spills are removed at

the close of the training exercise and properly disposed of off range. Human wastes, garbage, and litter generated at Marine encampments are also contained and removed from the range for proper disposal.

Contamination of off-range surface waters as a result of existing or continuing military activities is also unlikely. As noted in the preceding paragraph and as explained in Section 4.11, 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. Based on FY 1996 figures, which are considered to be typical for current and projected ordnance expenditure rates, about 550 live bombs are dropped on each HE Hill and about 40 Maverick Missiles are delivered on each live missile target annually. It is estimated that less than 10 percent of the live ordnance rounds delivered on the range fail to explode. Some of those unexploded rounds may be buried by the force of delivery, but a number of them remain on the surface until they 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. Over time the number of buried unexploded munitions has and would continue to accumulate. Before the explosives in these rounds could become potential groundwater contaminants, however, their bomb cases would have to be breached by the force of delivery impact or corrosion over time. 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.

Continued Military Use of Groundwater

Renewal of the BMGR would have the effect of continuing the use of groundwater by the Air Force and Marine Corps to support their operations. The projected annual use rate is about 211 acre-feet (or about 68.8 million gallons).

A water right held by the Air Force for up to an additional 1,802 acre-feet of groundwater annually would remain in effect. This water right serves as a contingency to support possible future military needs, but no specific plans to use this appropriation have been developed.

Continued Use of Surface Waters for Wildlife

The use of surface water to support wildlife management needs would be unaffected by the proposed renewal of the BMGR.

4.13.2 Alternative Action

The effects on water resources for the alternative action to renew the BMGR for 25 years would be indistinguishable from the proposed action.

4.13.3 No-action Alternative

The BMGR would not be renewed under the no-action alternative. The potential effects on water resources of not renewing the BMGR would include:

- # reduction in or cessation of military effects on water resources
- # development of surface water or groundwater to support new land uses that could potentially be approved following non-renewal of the BMGR land withdrawal
- # conveyance of existing water rights with the former range lands
- # potential for increased sedimentation of downstream surface water as a result of new or expanded non-military land uses
- # potential for ground water contamination as a result of new land uses
- # continued use of surface water and groundwater for wildlife management purposes

Reuse of BMGR Lands

Non-renewal of the BMGR would raise the potential that some range lands could be reopened for entry under the mining and mineral leasing laws and other public land laws. The introduction of new or expansion of existing non-appropriative land uses could also be precipitated by non-renewal of the range.

New water use issues and water resource effects would likely be raised by the introduction of either new appropriative or non-appropriative land use or the expansion of existing non-appropriative uses. Such land use changes for the former eastern and western range sections would be subject to approval through federal planning and environmental assessment processes. Management of these former range lands would initially continue to be directed by the Lower Gila South RMP Goldwater Amendment until new management planning prepared under FLPMA, NEPA, and other applicable regulations could be completed. The new management plan would specify how the former range lands may or may not be used for various appropriative and non-appropriative land uses. The environmental consequences of all proposed land uses on water resources would be addressed in the NEPA documentation accompanying the new management plan.

Air Force water rights would be conveyed with the former range lands following non-renewal of the BMGR.

Non-renewal of the BMGR land withdrawal would not affect land use within the Cabeza Prieta NWR. Hence, water resources within the refuge would not be directly affected by non-renewal of the range.

Effects of Ending Military Land Use

Non-renewal of the BMGR would end military land use of the range, including ordnance delivery and other ground uses. Termination of these activities would eliminate any further contamination of the range surface with expended ordnance and would end further physical surface disturbances caused by military training and support activities. Decontamination and efforts to stabilize and restore locations used for military purposes would reduce the potential for surface water contamination with suspended sediments or hazardous or toxic materials.

4.13.4 Management Actions

No mitigation actions are necessary to offset adverse effects of renewing the BMGR on water resources.

Renewing the BMGR withdrawal would continue the segregation of the range lands from entry for all forms of appropriative land use. Restrictions on most types of non-appropriative land use would also continue. These segregative and restrictive effects of renewing the range on land use land would have the consequence of precluding major surface water or groundwater

development for on- or off-range purposes for the duration of the withdrawal. Water development to support military needs, wildlife management requirements, or non-appropriative land uses compatible with the military purposes of the BMGR could occur, but the small scale of such potential projects are not likely to significantly or adversely affect the overall water resources of the range.

Ongoing management practices to minimize the surface disturbing effects of military activities; to prevent, contain, and clean-up spills of hazardous or toxic materials; and to contain and remediate the effects of aircraft crashes have minimized the potential effects of military use of the range on water resources. These practices would be continued during the proposed renewal of the BMGR.

Non-renewal of the BMGR under the no-action alternative would be followed by continuing EOD work to decontaminate the range, surface site restoration, and any required site remediation. Continuing EOD work in specified former target areas would reduce the presence of expended munitions on the range. Soil surfaces at former military use sites would be recontoured and stabilized per management practices, identified in consultation with the BLM, as offering the best promise of restoration success. The appropriate restoration methodology may vary on a site by site basis. Similarly, other types of site remediation requirements would be identified on a site by site basis through consultation with the BLM and other regulatory agencies.

Non-renewal of the range would prompt the development of specific plans to implement decontamination, surface restoration, and site remediation work. The outcome of this work would benefit water resources. No other water resource mitigation would be necessary under the no-action alternative.

4.14 AIR QUALITY

A mandatory requirement of determining the environmental consequences of the proposed action is to calculate sources of air pollutant emissions resulting from ground and aircraft operations, and compare them to the NAAQS. In addition, a State Implementation Plan (SIP) "Conformity Analysis" must be conducted in accordance with the general conformity rule promulgated by the EPA. On 30 November 1993, the EPA published the general conformity final rule in the *Federal Register* (58 FR 63214). The purpose of the rule is to ensure that federal actions conform to the SIP applicable to the project site. The applicable regulations are provided within Title 40 of the Code of Federal Regulations (CFR), Part 6, Part 51 Subpart W, and Part 93. A "federal action" is defined as any activity engaged in by a federal agency, department, or other entity, or any activity licensed, permitted, funded, or otherwise supported by a federal entity. "Conformity to a SIP" is defined as meaning adherence to a SIP's purpose of eliminating or reducing the severity and number of violations of the NAAQS and achieving expeditious attainment of such standards.

As a result of the general conformity rule, federal actions must be evaluated to assess whether emissions associated with the project will interfere with an area's air quality improvement plan. The general conformity rule applies only to federal actions that result in an emission of a criteria

pollutant for which an area has been designated as non-attainment. The rule requires that the net air emissions associated with a federal action be quantified and compared to established pollutant-specific de minimis threshold values using a methodology referred to as an applicability analysis (conformity applicability analysis or conformity analysis). The “de minimis” level is defined for special regulatory programs. For the purpose of this document, the de minimis level is emissions of 100 tons per year (TPY) for any criteria pollutant.

If implementation of the project will generate emissions exceeding the pollutant-specific de minimis threshold value, or if the project's emissions will represent a substantial increase (greater than 10 percent) over the base year emissions for a specific-pollutant, then a more detailed assessment, referred to as a conformity determination, must be conducted. If the emissions from a proposed action are below the de minimis level (100 TPY), and below 10 percent of the base year emissions, then it is not necessary to conduct a conformity determination.

In general, a project will conform if some combination of the following can be shown:

- # Total project (direct and indirect) emissions have already been accounted for in an approved SIP.
- # The applicable SIP for the planning area is revised to incorporate project emissions, and it is demonstrated that the inclusion of the project emissions will not result in the planning area exceeding the emissions budget (i.e., there is no net increase in emissions).
- # Atmospheric dispersion modeling performed at a local and/or regional level is conducted to show that emissions associated with the federal action would neither cause nor contribute to any new violation of any standard in any area, nor increase the frequency or severity of any existing violation of any standard in any area.
- # Emission reduction credits are purchased to account for all project emissions.
- # In some cases, an emissions assessment demonstrates that the project would not cause an increase in “base year” emissions, where base year emissions are emissions calculated using historic activity levels and current emission factors.

4.14.1 Air Pollutant Emissions

Aircraft Operations

Primary aircraft engine emissions include hydrocarbons (HC), carbon monoxide (CO), oxides of nitrogen (NO_x), sulfur dioxide (SO₂), and particulate matter smaller than 10 microns in size (PM₁₀). Except for sulfur dioxide, the quantity of these emissions (in lbs/hr) is determined primarily by the power setting of the aircraft engine. Hydrocarbons and carbon monoxide are very high during low power settings such as during taxiing and idling; as the power setting increases, these emission rates decline. However, emissions of oxides of nitrogen are directly

proportional to the power setting. During periods of low settings, when engine power and combustion temperatures are low, oxides of nitrogen emissions are low and are higher during the high power settings, like during take-off and climb-out.

Emissions of sulfur dioxide are related more to the sulfur content of the fuel and the amount of fuel burned per hour than the operating temperature of the engine. Although these emissions are highest during take-off and climb-out, there is not as much difference in emission rates among the power settings as seen with carbon monoxide or oxides of nitrogen. Emissions of PM₁₀ are the result of incomplete combustion and are somewhat higher at low power settings; however, total particulate emissions are highest during take-off and climb-out because fuel consumption is highest during these periods.

Of the primary pollutants emitted by aircraft engines, emissions of carbon monoxide and oxides of nitrogen are generally highest at all power settings. Although the EPA has established some standards for aircraft engine emissions, aircraft operations are not a regulated mobile source in terms of compliance with ambient air quality standards as would be a stationary area or point source that releases pollutants at ground or near ground levels.

The annual total aircraft emissions estimated for each pollutant for all areas combined, including those portions of the MTRs that lie within the study area, are presented in Table 4-4 for mixing heights of 0 to 1,500 feet and 0 to 5,000 feet. Fixed-wing aircraft provide a large percentage of the total emissions in the area. This is due primarily to the higher emission factors (lbs/hr) for the fixed-wing aircraft, although the larger inventory of the fixed-wing aircraft and their higher usage rate also contribute to the higher total emissions.

Mixing Level	Pollutant	Aircraft Emissions (lbs)
0-1,500 feet	carbon monoxide	708,087
	oxides of nitrogen	2,768,969
	Hydrocarbons	24,535
	sulfur dioxide	13,164
	Particulates	73,912
0-5,000 feet	carbon monoxide	1,249,358
	oxides of nitrogen	4,443,555
	Hydrocarbons	60,883
	sulfur dioxide	22,590
	Particulates	172,552

A method used to estimate effects to the surface air quality from aircraft flights is by examining the total aircraft emissions for one year within an imaginary box of given dimensions, depending on the area under consideration, and the height of the flight operations. This is a very conservative approach because it assumes: (1) no transport or mixing of the emissions outside the imaginary box, (2) all the pollutants emitted within the box are homogeneously mixed, and (3) the pollutants are non-reactive. However, it is unrealistic to assume that aircraft emissions are going to remain within a given volume of air over the period of one year.

The evaluation of aircraft emissions relies on such variables as the average mixing height, associated wind speed, and periods of restricted dispersion (Holzworth 1972). Based on the work of Holzworth, an average mixing height of 500 meters or less associated with an average wind speed of 4 meters per second or less never occurred for five consecutive days. Using a five-day period as a conservative estimate for no mixing or diffusion of aircraft emissions, “box concentrations” were calculated for the 0 to 1,500-foot level. The findings are presented in Table 4-5.

TABLE 4-5 “BOX CONCENTRATIONS” OF POLLUTANTS FOR A FIVE-DAY STAGNATION EPISODE						
Level	Pollutant	Conc. ($\mu\text{g}/\text{m}^3$)	NAAQS	Percent NAAQS	Background ($\mu\text{g}/\text{m}^3$)	Percent Background
0-1,500 ft.	CO	<1	10 (8 hr)	<1	6	<1
	NO _x	5	100	5	37	14
	HC	<1	—	—	—	—
	SO ₂	<1	80	<1	42	<1
	Particulates	<1	50	<1	30	<1

The concentrations listed in this table represent ambient concentrations that may occur if all the assumptions of a “box model” are upheld for five consecutive days. The concentrations are well below both the federal and state standards and would account for only a small percentage of most of the “background” concentrations. All concentrations shown are annual concentrations except where noted. Background concentrations are based on actual monitored data averages of four locations near the study area: Yuma, Ajo, Casa Grande and Tucson.

Ground Operations

Military operations on the eastern side of the BMGR are administered by the U.S. Air Force, and include the North, South, and East tactical ranges, as well as Manned Ranges 1, 2, 3, and 4. Military operations on the western portion of the BMGR are controlled by the U.S. Marine Corps, and include the Moving Sands/Cactus West Target Complex and various ground support areas. Table 4-6 provides total emissions from ground activities. Several sources of particulate emissions were evaluated in this analysis. These sources include vehicular traffic on paved and unpaved ground, ordnance explosions, ordnance burning, generator use, and boiler use.

TABLE 4-6
SUMMARY OF CRITERIA POLLUTANT EMISSIONS
FROM GROUND ACTIVITIES AT THE BMGR
(values in pounds per year)

Location	PM ₁₀	NO _x	CO	SO ₂
Manned Ranges 1-4 Paved Road	818	0	0	0
Manned Ranges 1-4 Unpaved Road	27,009	0	0	0
N,S,E TAC Ranges Paved Road	1,636	0	0	0
N,S,E TAC Ranges Unpaved Road	39,153	0	0	0
Marine Corps Operations Paved Road	424	0	0	0
Marine Corps Operations Unpaved Road	28,447	0	0	0
North TAC Explosives Blasting	334	0	0	0
South TAC Explosives Blasting	264	0	0	0
East TAC Explosives Blasting	346	0	0	0
Marine Corps Operations Blasting (Large)	614	0	0	0
Marine Corps Operations Blasting (Small)	5,990	0	0	0
Manned Range 1 Explosives Detonation	5	0	0	0
Manned Range 2 Explosives Detonation	5	0	0	0
Manned Range 3 Explosives Detonation	5	0	0	0
Manned Range 4 Explosives Detonation	5	0	0	0
BMGR Explosives Burning	9	8	3	0
Gila Bend Boilers	39	394	98	14
Gila Bend and Other Generators	10	103	26	4
Marine Corps Operations Generators	80	800	200	28
TOTAL (lbs/yr)	105,193	1,305	327	46
TOTAL (TPY)	52.6	0.7	0.2	0.02

Vehicular impacts were estimated from maximum annual usage. There are 24 types of vehicles used on the eastern portion of the BMGR, and 5 types of vehicles commonly used on the western portion of the BMGR. Emissions from vehicles were estimated using EPA AP-42 emission factors for sources from paved and unpaved roads. The AP-42 document is an industry or source-specific manual listing EPA generated emission factors for various pollutants.

Ordnance deployment sources included emissions from the bi-monthly detonation of unexploded ordnance collected by EOD personnel. Each manned range is cleared of inert practice ordnance every 50 use days. Six times each year, ordnance from the EOD sweep is detonated at each of the manned ranges to ensure all spotting charges have been fired. Each detonation is equivalent to approximately 100 to 300 pounds of TNT. The emissions from this ordnance are likely counted twice (ordnance deployment and ordnance detonation) in the total emissions from the BMGR. Emissions from explosives burning were also calculated. Generally only one burning event is performed each year. In 1996, one burn of 12 pounds of explosives was performed. The EPA AP-42 emission factors for explosives burning and the conservative assumption of 100 pounds of

explosives burned were used. The AP-42 emission factors for explosives blasting and detonation only includes PM₁₀. There are no emission factors for carbon monoxide, sulfur dioxide, or oxides of nitrogen.

The Air Force uses approximately 20 generators (operated up to 500 hours per year) and four boilers at the Gila Bend AFAF. Oxides of nitrogen, sulfur dioxide, PM₁₀, and carbon monoxide are the primary pollutants emitted from these sources. The generators and boilers are permitted by the Maricopa County Environmental Services Department. The EPA AP-42 emission factors for external combustion sources were used for boilers, and the emission factors for gasoline and diesel industrial engines were used for the generators. Two of the boilers burn #2 diesel fuel and the other two burn propane. All of the generators burn diesel fuel (assumed to be #2). The calculations for the Air Force generators were based on a 500 hour/year usage rate to obtain a worst case emission scenario.

The Marine Corps uses approximately 40 generators for daily operations in the western section of the BMGR. Each generator operates approximately 8 hours a day, 7 days a week. The EPA emission factors for gasoline and diesel industrial engines were used for the generators. All of the generators burn diesel fuel (assumed to be #2). The calculations for the Marine Corps generators were calculated by doubling the reported annual fuel usage to obtain a worst case emission scenario.

4.14.2 Proposed Action

The proposed action to renew the BMGR indefinitely would result in the continuation of current flight operations in the study area. Likewise, no changes to the existing ground operations are proposed. Consequently, the air quality impacts would remain the same as they are now and no net increase in criteria emissions is anticipated to occur.

A conformity applicability analysis was conducted to assess whether the proposed action, renew the BMGR would conform to the applicable SIP. The analysis was conducted for the relevant criteria pollutants for which areas have been designated as non-attainment areas. In addition, only those air emissions occurring from ground level to 0 to 5,000 feet above ground level were examined. The purpose of the conformity analysis is to determine if net emission increases of criteria pollutants in excess of 100 TPY are anticipated to occur. Table 4-7 summarizes emissions calculated to occur under the proposed action scenario.

Because these emission values represent ongoing conditions, no net increase in criteria pollutants, either within the non-attainment areas or throughout the BMGR, is anticipated to occur. This finding is applicable to the proposed action, alternative action, and the no-action alternative.

<p style="text-align: center;">TABLE 4-7 SUMMARY OF TOTAL EMISSIONS (TPY) UNDER THE PROPOSED ACTION</p>
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	CO	NO_x	HCS	SO₂	PM₁₀
Aircraft Operations	624.7	2,222	30	11	86
Ground Operations - Vehicles	0.2	0.7	*	0.02	53
TOTAL	625	2,223	30	11	139
* VOC emissions are considered negligible					

4.14.3 Alternative Action

The alternative action would renew the BMGR as a military reservation for 25 years. If selected, military flight operations would continue in the study area at similar training tempos and ground operations would remain similar to existing operations. Consequently, with this alternative, no additional impacts to the ambient air quality are anticipated.

4.14.4 No-action Alternative

The no-action alternative would discontinue the military withdrawal of the BMGR beginning in 2001. As a consequence of this action, military aircraft operations in the airspace overlying the BMGR would likely be substantially reduced, and some reduction would also be expected within the Sells MOA, LATN, and MTRs that terminate in the BMGR. The very conservative “box model” used to estimate the contribution of aircraft emissions to the ambient levels of the defined pollutants has illustrated that current impacts are minimal at most. It is estimated that discontinuing military aircraft operations within the study area would result in little or no reduction in the ambient concentrations of the area because current operations contribute minimally to these concentrations.

With regard to ground operation, the no-action alternative would reduce the current minimal impacts on air quality because of the decrease in military activities in the BMGR. At this time, future use of the land cannot be projected with the no-action alternative, but could potentially include recreational activities, grazing, and/or mining. If new activities are proposed, a new analysis of air quality effects of those proposals may need to be performed by the agencies involved.

4.14.5 Management Actions

None of the alternatives would cause or contribute to any net increase in regulated air pollutant emissions within the study area. Therefore, no mitigation measures or management actions are necessary.

4.15 BIOLOGICAL RESOURCES

4.15.1 Proposed Action

Vegetation

The proposed action to renew the BMGR would result in the continuation of ongoing military training operations. Consequently, vegetation loss would continue from grading activities associated with maintenance of existing roads and target areas, and damaging of vegetation from off-road use of vehicles, primarily during EOD cleanup activities. Disturbance to vegetation from delivery of ordnance is limited because ordnance delivery is restricted to specific target areas that are already mostly clear of vegetation.

Vegetation associated with ephemeral water courses and aeolian dunes are of particular concern due to their limited distribution on the BMGR and their value to wildlife and plants. Target areas include numerous ephemeral drainages that are subject to vegetation damage during EOD cleanup. There are no aeolian dune systems within areas of existing ground-disturbing military activities; because no new activities are proposed, aeolian dune systems would remain unaffected.

Military activities on the ground within the Cabeza Prieta NWR are limited to five remotely located, unmanned communications sites. Although an estimated 1,612 of the formerly used and highly visible DARTs are present on the Cabeza Prieta NWR as fall out from former use of the alternate air-to-air range, the impact on vegetation and soils is negligible.

Wetlands and Floodplains

According to Geraghty & Miller (1997), only 15 of the 206 aquatic sites identified within the BMGR occur within 0.5 mile of military facilities or activities. Aquatic sites include artificial as well as natural water sources. Only 19 of the 206 aquatic sites would classify as wetlands by definitions in Executive Order 11990 (Wetlands Protection) or the Clean Water Act. None of the 15 sites within 0.5 mile of military activities would be classified as a wetland. These 15 sites include six wells, two natural tinajas, three charcos, three catchments, and one reservoir. All of the wells, one charco, and two catchments were determined to be in the immediate vicinity of surface disturbing activities. These nine sites are located in the Cannon Air Defense Complex; one proposed MCAS Yuma ground support area; Marine Corps TACTS Range; Stoval Airfield; and North, South, and East TACs. Geraghty & Miller (1997) reports there is only a slight possibility that surface aquatic features are associated with the wells and catchments. Only the charco, located in the vicinity of Stoval Airfield, has the potential for a limited wetland area that may be impacted by military training activities.

There are 238 miles of ephemeral streams within 0.5 mile of military facilities or activities (Geraghty & Miller 1997). This represents approximately 4.9 percent of the total mileage of mapped ephemeral streams.

Military use roads have localized impacts on floodplains and overland sheet flow. These impacts may affect downstream habitats. Ponding of rainwater along roadsides may result in increased vegetation density along roads (Geraghty & Miller 1997).

Wildlife Habitat

The majority of ground-disturbing activities on the BMGR are within lowland habitats. Military facilities and activities in upland habitats include instrumentation sites and a few air-to-ground targets on the TAC Ranges. Grading to maintain target areas would result in removal of re-established vegetation and destruction of burrows of small mammals and reptiles. Vegetation damage may occur from EOD sweeps to clear ordnance debris within one NM of the target sites. Vegetation damage from EOD activities is of particular concern in microphyll woodlands, which are especially sensitive and valuable wildlife habitats on the BMGR. EOD cleanups also result in impacts to small mammal and reptile populations as a result of shallow burrows being caved in by off-road vehicular movements. With the exception of the negligible impact of munitions and target debris from the formerly used DARTs, wildlife habitat on the Cabeza Prieta NWR is not impacted by military activity.

Six wells, two natural tinajas, three charcos, three catchments, and one reservoir were identified within 0.5 mile of military facilities or activities (Geraghty & Miller 1997). With the exception of the wells, these sites may provide a source of open water for wildlife. One charco and two catchments are in the immediate vicinity of surface disturbing activities. Elevated levels of aluminum, boron, and magnesium have been observed in crater sediments (USAF 1997). Ordnance delivery at or near aquatic sites could potentially result in contamination of water consumed by wildlife.

Although testing of soil, water, and vegetation at one of the craters at the HE Hill on South TAC indicated levels of constituent (i.e., aluminum, boron, and magnesium) were too low to be a health concern to animals (Thorson 1996 in USAF 1997), more information is needed to assess potential impacts on wildlife.

General Wildlife

Direct impacts to wildlife species involve mortality, injury, or disturbance from human activities. Delivery of inert or high explosive ordnance in target areas as well as vehicle use can result in mortality or injury to wildlife. Some species, such as flat-tailed horned lizards, are particularly vulnerable to mortality from vehicle use on or off roads. Disturbance from annual and 5-year EOD cleanups is infrequent yet extensive, potentially impacting wildlife within a one-NM radius of manned and tactical range target sites.

Birds or bats that collide with aircraft are another source of wildlife mortality on the range, particularly because military aircraft may fly at low altitudes and at high speeds. This problem

does not appear to be significant because these deaths are relatively rare and are unlikely to jeopardize the continued health of any population of any species on the range.

Noise from aircraft overflights can also disturb wildlife. A number of studies of the effects of noise on wildlife have been conducted in diverse settings. Although there appears to be consensus among investigators that noise does affect wildlife and that these effects are increased by the magnitude, frequency, and duration of the noise, few conclusions have been reached concerning the extent or significance of such changes. Wildlife responses to aircraft range from apparent disregard to panic fleeing, and vary with season, reproductive status, exposure to aircraft, aircraft type, distance from aircraft, and other factors. Studies indicate that ungulates (hoofed animals) may respond to low-level overflights with increased heart rates and have been observed fleeing low-level aircraft (Hughes and Smith 1990 in USFWS 1996, Krausman et al. 1986, Weisenberg et al. 1996, Workman et al. 1992). However, these investigators concluded that aircraft disturbances monitored in these studies were minimal and of short duration. Additionally, the investigators concluded that the responses of the animals decreased with increased exposure, suggesting that they habituate to the disturbance.

Evidence for lack of significant effects of aircraft noise on wildlife include the apparent lack of impact of many long-term aerial wildlife surveys with helicopter and light aircraft, the persistence and abundance of wildlife species in low-level flight areas, and the observed habituation of some wildlife to aircraft. However, most investigators have expressed the opinion that additional research is required concerning the effects of aircraft noise on wildlife.

Indirect impacts involve loss or degradation of habitat from removing or damaging vegetation and destruction of animal burrows during grading and EOD activities. Impacts to vegetation in microphyll woodland would affect an important source of food and shelter for wildlife species.

Because the majority of military activities take place in lowland habitats, impacts from military activities are likely to have a greater effect on wildlife species that typically occupy lowland areas. Species often found in lowland habitats include pronghorn, coyotes, kit fox, badgers, kangaroo rats, pocket mice, LeConte's thrasher, loggerhead shrikes, black-throated sparrows, lesser nighthawks, and numerous reptile species. Species that frequent microphyll woodlands along ephemeral drainages in lowland areas include mule deer, pronghorn, gray foxes, bobcats, and Harris' hawks.

Sensitive Species

The following discussion addresses potential impacts to sensitive wildlife species that are known or expected to occur on the BMGR. Military withdrawal, management of the ACECs, and other land management policies on the BMGR eliminate potentially detrimental land uses (such as mining, geothermal development, agriculture, and livestock grazing) that may affect wildlife habitat or disturb sensitive species. Poaching or other illegal activity is rare due to restricted access to the BMGR (USFWS 1996).

The following discussions reference three biological opinions issued by the USFWS. An opinion was issued on 17 April 1996 regarding the effects of MCAS Yuma proposals on the BMGR (addressed in the Yuma Training Range Complex EIS) to Sonoran pronghorn, flat-tailed horned lizard, lesser long-nosed bat, and cactus ferruginous pygmy owl. Two biological opinions were issued regarding the proposed BMGR renewal of the military land withdrawal. The first opinion, dated 27 August 1997, addresses impacts of the proposed action on Sonoran pronghorn. The second opinion, dated 30 October 1997, addresses impacts to the lesser long-nosed bat, cactus ferruginous pygmy owl, and peregrine falcon.

Lesser Long-nosed Bat - Federally listed as Endangered

The April 1996 opinion found that the MCAS Yuma proposed activities are not likely to adversely affect the lesser long-nosed bat. The October 1997 biological opinion determined that the proposed action to renew the BMGR may affect but is not likely to adversely affect lesser long-nosed bat. The concurrence was based on the following considerations:

- # no lesser long-nosed bat roost sites have been identified on the non-refuge portions of the range
- # potential foraging areas were found to be only minimally used
- # no discernible short-term effects were measured from aircraft overflights
- # lesser long-nosed bat exposure to military activities is estimated to be no more than 100 minutes a night and encounters are highly unlikely

Because mining is prohibited and human access is restricted on the BMGR, disturbance to potential roost sites from mine entries is limited. Known roost sites on the Cabeza Prieta NWR appear to be far enough from Weapons Tactics Instructor (WTI) flight corridors to avoid disturbance (USFWS 1996, USAF 1997).

The proposed action may impact potential foraging habitat. Food plants of the lesser long-nosed bat (agaves and columnar cacti) are associated with upland habitats. Because the majority of military activities take place in lowland areas, impacts to potential foraging habitat would be limited. The continuation of ground-disturbing activities such as ordnance delivery, grading, and off-road use of vehicles in upland habitats may result in some damage to or removal of food plants.

California Leaf-nosed Bat - Wildlife of Special Concern in Arizona

Significant impacts from disturbance of roost sites are not expected on the BMGR because human access is restricted and mining activities are not allowed. Although California leaf-nosed bats forage widely and not exclusively at water sources, the provision of artificial waters on the BMGR likely benefits the species by providing additional foraging opportunities and a source of drinking water. With the exception of one charco and two catchments (Geraghty and Miller 1997), water sources on the BMGR are not in the immediate vicinity of surface disturbing activities. Potential impacts to roosting and foraging bats from noise disturbance associated with ordnance delivery and aircraft overflights is unknown.

Sonoran Pronghorn - Federally Listed as Endangered

The August 1997 biological opinion indicates that the proposed action is not likely to jeopardize the continued existence of the Sonoran pronghorn. The opinion mainly focuses on the eastern half of the BMGR and refers to the April 1996 Biological Opinion for discussion of impacts on the western half of the BMGR. The April 1996 opinion determined that MCAS Yuma's existing and proposed activities on the BMGR were not likely to jeopardize the Sonoran pronghorn.

Reasonable and prudent measures and terms and conditions to implement those measures as mandated by the USFWS in the August 1997 Biological Opinion are summarized below:

- # Minimize impacts of U.S. Air Force activities on Sonoran pronghorn by eliminating use of full-scale live or inert ordnance on South TAC between 1 March and 15 April, maintaining a minimum flight altitude of 500 feet AGL, and briefing all users of the BMGR on the importance of reducing impacts to Sonoran pronghorn.
- # Minimize habitat loss, degradation, and fragmentation by restricting vehicles to existing designated roads (with the exception of EOD and environmental/archaeological personnel), limiting surface disturbance, minimizing erosion during construction work, preventing pollution of soil and drainages, controlling speed limits on roadways, and determining aluminum levels in water and forage plants.
- # Monitor and study reactions of Sonoran pronghorn to military activities. This would involve monitoring radio-collared pronghorn, determining what attracts pronghorn to target areas in North and South TAC, and studying pronghorn reactions to missions. Specific issues to be addressed include the effects of noise and visual impacts from overflight missions, effects of military activities conducted at night on pronghorn, and impacts of military activity on fawning.
- # Provide an annual report on monitoring and study efforts with complete and accurate records of all incidental take and how reasonable and prudent measures have been implemented. Anticipated incidental take is one direct mortality per ten years, and up to two take in the form of harassment that is likely to injure (harm) Sonoran pronghorn.

There have been no documented pronghorn mortalities directly linked to military activities. However, there is the potential for mortalities to occur from ordnance deliveries on manned and tactical ranges, air-to-air live ammunition, and collisions with ground vehicles. Based on the distribution of Sonoran pronghorn, the highest risk from ordnance delivery appears to be on South and North TAC and Manned Range 1. Fall-out from live aerial gunnery training occurring in the air-to-air range is also high risk; however, as noted in Section 3.3.2, the frequency of aerial gunnery training is markedly lower than the frequency of air-to-ground training in the manned and tactical ranges (only 36 aerial gunnery sorties were performed during FY 1996). Of the estimated 1.25 million acres of pronghorn range on the BMGR (USAF 1997), approximately 27,606 acres are regularly impacted by air-to-ground ordnance and annual EOD activity; and about 101,040 acres are within the primary air-to-air live fire areas. The majority of roads in South and North TAC and Manned Range 1 are unimproved, allowing only relatively low speed travel. Low speeds combined with high visibility in open terrain reduces the potential for collisions with pronghorn.

Disturbance from overflights and ground activities present additional potential impacts on pronghorn on the BMGR. Aircraft overflight, particularly low-level flights, may cause pronghorn to flush from cover (Hughes and Smith 1990, Workman et al. 1992, Luz and Smith 1976 in USFWS 1996) or avoid areas (Bleich et al. 1990, Krausman et al. 1986 in USFWS 1996). Pronghorn may also respond to aircraft noise with increased heart rates (Hughes and Smith 1990 in USFWS 1996; Krausman et al. 1986; Weisenberger et al. 1996; Workman et al. 1992). Pronghorn studied in Utah showed less response to jet aircraft overflights than to small fixed-wing aircraft or helicopters (Workman et al. 1992). Studies of pronghorn and other ungulates suggest that animals habituate to overflights (Workman et al. 1992, Weisenberger et al. 1996, Krausman et al. 1993a and 1993b). Within the pronghorn range, Air Force aircraft maintain a minimum altitude of 1,500 feet AGL on the Cabeza Prieta NWR except in flight corridors established for the semi-annual WTI course where aircraft fly down to 500 feet AGL. Fixed-wing aircraft maintain a minimum altitude of 500 feet AGL over the remaining eastern portion of the BMGR (USAF 1997). Most helicopter use of the Gila Bend segment of the BMGR is outside the known range of Sonoran pronghorn (USAF 1997).

Other potential sources of disturbance include ordnance delivery, strafing, EOD activities, use of air-dropped flares at night, and human ground activity on manned and TAC ranges. EOD cleanup activities in pronghorn habitat affect about 27,606 acres annually, and about 114,900 acres every five years. Pronghorn flee from vehicles and people, usually running far enough to disappear from view (Wright and deVos 1986, Hughes and Smith 1990 in USFWS 1996). A stinger team operating area at the north end of the Sierra Pinta Mountains is frequented by pronghorn. The Sonoran Pronghorn Core Working Group recommended that it not be used from March through April, the peak of fawning activity, and MCAS Yuma agreed (USFWS 1996).

Ingestion of contaminated water in bomb craters could potentially affect the health of individual pronghorn. Levels of aluminum, boron, and magnesium from about 12 to 15 times background levels have been detected in crater sediments (USAF 1997). Although levels of constituents tested in soil, water, and vegetation at one of the craters on the South TAC HE Hill were

determined to be too low to be a health concern to animals (Thorson 1996 in USAF 1997), more information is needed to determine impacts of contaminated waters on pronghorn.

Although potential impacts to Sonoran pronghorn exist as a result of military activity, the USFWS determined that the proposed action is not likely to jeopardize the continued existence of the Sonoran pronghorn. This determination was based on the following considerations (USFWS 1997):

- # The Sonoran pronghorn has persisted for more than 40 years with the same military activities on the BMGR.
- # The proposed action does not result in additional habitat loss or degradation.
- # No mortalities have been directly linked to military activities and less than one death per 10 years is foreseen.
- # Pronghorn are expected to continue known behaviors (reproduction, feeding, resting, and rutting) where military activities occur.

Peregrine Falcon - Federally listed as Endangered

Peregrine falcons may pass through during migration, but do not breed or winter on the BMGR (Barry 1997b; Johnsgard 1990). Military activities are not expected to have any impacts on migrating peregrine falcons. On 30 October 1997, the USFWS concurred with the Air Force finding that activities on the BMGR may affect but are not likely to adversely affect the peregrine falcon because the species is only transient on the BMGR. Ongoing Marine Corps activities were also determined to have no effect on peregrine falcon.

Cactus Ferruginous Pygmy-Owl - Federally listed as Endangered

On 30 October 1997, the USFWS concurred with the Air Force's finding that activities on the BMGR may affect but are not likely to adversely affect the cactus ferruginous pygmy-owl with the condition that the Air Force continue surveys for the owl on the BMGR. This concurrence was based on the following considerations:

- # no owls have been detected despite multiple surveys on the BMGR
- # flights are restricted to an above-ground level of 500 feet
- # surveys for the owl will continue
- # no planned activities will cause destruction of cactus ferruginous pygmy owl habitat

Most ground-disturbing military activities on the BMGR occur on creosote bush flats, a vegetation type that does not contain characteristics of pygmy owl habitat. Therefore, it is unlikely that potential habitat for the cactus ferruginous pygmy-owl would be affected by

ground-disturbing activities (USAF 1997). If the owls were present on the BMGR, potential impacts would be limited but may include mortality from ordnance delivery, collisions with vehicles and aircraft, noise and visual disturbance, and habitat degradation (USAF 1997). If any owls are observed on the BMGR, the Air Force will reinitiate consultation with the USFWS. Similarly, the USFWS (1996) concluded that Marine Corps activities on the BMGR are not likely to jeopardize the continued existence of the cactus ferruginous pygmy owl subject to the similar conditions already described for the Air Force. No owls have been detected during the subsequent surveys conducted on the BMGR by the Marine Corps.

Flat-tailed Horned Lizard - Wildlife of Special Concern in Arizona

The distribution of the flat-tailed horned lizard is within the westernmost portion of the BMGR. As part of an earlier consultation in 1996, the USFWS issued a biological opinion for the effects of Marine Corps activities on the BMGR and determined that such activities were not likely to jeopardize the flat-tailed horned lizard. The USFWS anticipates incidental take at 23 direct mortalities per year, 10 individuals harmed by habitat loss or degradation, and an undetermined number harassed by moving them out of harm's way.

Reasonable and prudent measures identified by the USFWS in the biological opinion are summarized below:

- # implement personnel and visitor education programs and well-defined operational procedures
- # to the extent practicable, locate military activities outside of flat-tailed horned-lizard habitat. Move lizards from harm's way where adverse effects cannot be avoided
- # monitor and report to the USFWS incidental take resulting from military activities

Since the issuance of the biological opinion, MCAS Yuma has entered into a conservation agreement to implement a flat-tailed horned lizard range-wide management strategy. Adoption of the conservation agreement led to the withdrawal of the proposed rule to list the species on 15 July 1996.

Flat-tailed horned lizard habitat on the BMGR occurs within three special management areas—the Gran Desierto Dunes ACEC, the Yuma Desert and Sand Dunes Habitat Management Area, and the Tinajas Altas Mountains ACEC. Off-road vehicle use, camping, new rights-of-way, and other land use authorizations are limited in these areas (Flat-tailed Horned Lizard Working Group of Interagency Coordinating Committee 1997). An EOD operating area, rifle range, and the Cannon Air Defense Complex are within the known range of the flat-tailed horned lizard. The Cactus West and Moving Sands target sites are at or near the eastern edge of the species' range (USFWS 1996).

Potential impacts resulting from military activities involve mortality, noise disturbance, collection of lizards, and habitat loss or degradation. Potential mortality factors resulting from

the proposed action include ordnance delivery, take-off and landing of aircraft, grading of ground support and target areas, and on- and off-road use of vehicles. Military activities may attract predators such as ravens by providing perch sites (antennas and towers) and water. Spills of hazardous materials such as fuels and oils may be toxic to lizards or plants. Aircraft noise may result in hearing loss and altered behavior in lizards. Individual lizards may be collected as pets by military and civilian personnel (USFWS 1996). Grading and soil disturbance can result in habitat loss or degradation by removing vegetation and encouraging establishment of non-native plants.

Cowles Fringe-toed Lizard - Wildlife of Special Concern in Arizona

Because Cowles fringe-toed lizard is found in and adjacent to the Mohawk and Gran Desierto dunes (AGFD 1988), only military activities in the proximity of these areas are expected to affect the species. The Cactus West Target is located at the edge of the Yuma dunes. Ordnance delivery, grading of the target area, and on- and off-road use of vehicles may result in mortality of lizards. Loss or degradation of Cowles fringe-toed lizard habitat would occur when vegetation is removed through ground-disturbing activities. Other potential impacts to this species are similar to those expected for the flat-tailed horned lizard, including increased predation, exposure to hazardous materials, and noise disturbance.

Sonoran Desert Tortoise - Wildlife of Special Concern in Arizona

Sonoran desert tortoises do not appear to occupy the intermountain flats, where the majority of ground-disturbing military activities occur. However, some military facilities and activities such as instrumentation sites and a few air-to-ground targets on the TAC ranges, occur in upland habitats where desert tortoise may occur. Tortoises may be killed by ordnance delivery, grading of roads or target areas, and on- and off-road use of vehicles. Grading and EOD activities may also destroy tortoise burrows and cause habitat loss or damage. As with other reptile species, additional potential impacts to Sonoran desert tortoise include increased predation by providing perch sites and water, exposure to hazardous materials, tortoise collection, and noise disturbance.

AcuZa Cactus - Federal Candidate

Potential habitat for the cactus has been identified east of State Route 85 in the area of East TAC and Manned Range 3. Surveys in this area located only one individual cactus outside of the target areas (Geraghty & Miller 1997). Ordnance delivery and other ground-disturbing activities such as grading, EOD cleanup, and other off-road use of vehicles, may result in destruction of individual cacti and habitat.

Sand Food - Highly Safeguarded, Arizona Native Plant Law

There are no ground-disturbing military activities where sand food is known to occur on the BMGR. The plants may occur on the Gran Desierto Dunes, which are partially impacted by activities at the Cactus West Target area. Ordnance delivery and use of off-road vehicles (especially during EOD decontamination) could potentially damage sand food plants.

Blue Sand Lily - Salvage Restricted, Arizona Native Plant Law

There are no ground-disturbing military activities in the dunes at the western base of the Gila Mountains or at Pinta Sands, where the blue sand lily is known to occur. If the species is present elsewhere on the BMGR, plants may be damaged by off-road vehicles.

Kearney Sumac - Salvage Restricted, Arizona Native Plant Law

There are no ground-disturbing activities in the Tinajas Altas and Gila mountains where there are known populations of Kearney sumac. Because the plants occupy dry cliffs, ground-disturbing military activities other than construction of new instrumentation sites would not be expected in potential habitat. Because no new instrumentation sites are proposed, no Kearney sumac plants are likely to be affected.

4.15.2 Alternative Action

The difference between the alternative action and the proposed action is largely administrative. Military activities and use of the BMGR would be the same under each alternative. Therefore, potential impacts on vegetation, wetlands and floodplains, wildlife habitat, general wildlife, and special status species resulting from the proposed action would be similar for the alternative action. Because the alternative action requires congressional reauthorization for renewal of the BMGR following 25 years, another EIS would be prepared at that time. Congressional review under the proposed action would also consider environmental impacts, but such consideration may not involve as detailed of an analysis as that associated with an EIS. Regardless of the action alternative, consultation with the USFWS would have to be reinitiated if there are changes in potential impacts to threatened and endangered species, or incidental take levels are exceeded.

4.15.3 No-action Alternative

Under the no-action alternative, the BMGR would not be renewed as a military land withdrawal and reservation and the land would be managed by BLM and USFWS under existing authorities. Impacts associated with military activities on the ground would no longer occur. However, land uses presently prohibited under military withdrawal, such as mining, agriculture, and livestock grazing, may be allowed to occur on the BMGR. Such uses, if authorized, would present

additional impacts from which biological resources have long been protected on the BMGR. Such impacts would be evaluated through preparation of additional NEPA documentation in the event that new land uses are proposed for the BMGR. The following is a brief description of general impacts associated with some of the possible future land uses on the BMGR.

If mining were to occur on the BMGR, especially open-pit mining, the activities could result in a temporary loss of vegetation and wildlife habitat. Mining reclamation, however, is required by BLM regulations, and can result in recovery of the wildlife habitat to conditions similar to what was in place prior to mining. Mining activities involving existing abandoned mines may result in mortality of roosting bats. Disturbance in and around roost sites can cause bats to abandon roost sites. Disturbance-related impacts on other wildlife species could include displacement, or disruption of breeding and foraging activities. Use of haul trucks and other vehicles to and from the mine site may result in collisions with wildlife.

In the absence of military withdrawal, some areas may potentially be subject to residential, commercial, industrial, or agricultural development. Significant agricultural development of the BMGR is unlikely due to soil conditions and the distance to sources of either surface water or ground water. Agricultural development, if authorized, would be under an agricultural lease where the federal government would receive lease fees from the agricultural permittee. The only likely area where agricultural development might take place is in the vicinity of Wellton and Tacna, Arizona where there is currently limited agriculture (primarily citrus orchards and jojoba farming). If agricultural development were to take place, it would result in vegetation loss, destruction or degradation of wildlife habitat, and wildlife mortality and displacement.

If livestock grazing were to take place on the BMGR, it would most likely be in the form of an ephemeral grazing lease. Ephemeral grazing is authorized in areas like much of southwestern Arizona where the landscape usually does not provide enough forage to support any livestock. Ephemeral grazing allotments may be found on BLM-managed public land near the BMGR, although there are many areas of public land that have no livestock leases of any kind. Under an ephemeral lease, livestock grazing is authorized only when there has been sufficient rainfall to produce an abundance of annual forage and the grazing of livestock will not significantly impact other natural resources.

4.15.4 Management Actions

Proposed Action

The mitigation measures outline below apply specifically to special status species; however, many of the measures would protect other biological resource as well.

- # Potential impacts to the endangered Sonoran pronghorn would continue to be minimized by eliminating use of full-scale live or inert ordnance on South Tactical Range and maintaining a minimum flight altitude of 500 feet above ground level during the fawning

season between 1 March and 15 April. All users of the BMGR would receive briefings on the importance of reducing impacts to Sonoran pronghorn.

- # Sonoran pronghorn habitat loss, degradation, and fragmentation would continue to be minimized by restricting vehicles to existing and designated roads (with the exception of EOD and environmental/archaeological personnel), limiting surface disturbance, minimizing erosion during construction work, preventing pollution of soil and drainages, controlling speed limits on roadways, and determining aluminum levels in water and forage plants.
- # Reactions of Sonoran pronghorn to military activities would continue to be monitored and studied, as necessary.
- # Personnel and visitor educational programs and well-defined operational procedures on the importance of reducing impacts to the flat-tailed horned lizard (a wildlife species of special concern in Arizona) are being implemented and would be continued.
- # To the extent possible, military activities would continue to be located outside of flat-tailed horned lizard habitat.
- # Flat-tailed horned lizards would be moved from harm's way when possible adverse effects could not be otherwise avoided.
- # The Air Force, BLM, and MCAS Yuma, as appropriate, would continue to implement the measures contained within the flat-tailed Horned Lizard Rangewide Management Strategy (completed in May 1997).
- # Incidental take of any special status species resulting from military activities would continue to be monitored and reported to the USFWS.

Alternative Action

The alternative action would result in the same impacts and mitigation strategies described above for the proposed action.

No-action Alternative

Under the no-action alternative, there would be no impacts associated with existing military activities. Effects from decontamination activities and removal of military facilities on the range would be addressed in separate NEPA documentation, which would consider possible mitigation measures for these activities. Impacts from alternative land uses and associated mitigation measures would be evaluated through additional NEPA documentation following a public planning process for the future use of these lands.

4.16 ENVIRONMENTAL JUSTICE

4.16.1 Methods

Guidelines for including environmental justice impact analyses in NEPA documents are forthcoming. The CEQ is expected to release a guide for integrating environmental justice into NEPA documents at any time. In November 1997, the Department of the Air Force released an *Interim Guide for Environmental Justice Analysis with the Environmental Impact Analysis Process* and, wherever possible, the environmental justice analysis for this LEIS was performed in accordance with this guide.

The environmental justice impact assessment considers all of the environmental impacts reported in previous sections. Only the noise impacts associated with renewal of the range and the socioeconomic impacts associated with non-renewal of the range have been found to require environmental justice analysis. These are the only two resource areas where the environmental effect, including human health, economic, and social effects, could impact minority populations, low-income populations, or an Indian tribe.

GIS overlay of noise and socioeconomic data was the primary evaluation tool for the environmental justice analysis. The noise impact footprint was defined from existing data from the AUX-2 and Gila Bend AFAF AICUZ studies. Data from the 1990 census were obtained from the U.S. Census Bureau through ESRI ArcViewTM GIS packaged software and the U.S. Census Bureau internet home page. These data were used to establish the baseline demographics for affected counties and census tracts, including population, population composition (race and ethnicity), and poverty status. The methodology for socioeconomic modeling and the demographic data, which are used in the environmental justice analysis, are addressed in Section 3.9. Disproportionate impact was determined by measuring the impacts to minority and low-income populations and Indian tribes against the total affected population.

4.16.2 Definitions

Community of Comparison

In order to evaluate disproportionate impacts to minority and low-income populations, a basis for demographic comparison must be established. The Community of Comparison (COC) is comprised of the total affected population and a representative demographic sample of the unaffected population. The determination of the representative COC is arrived at by determining the demographic profile of the smallest governmental or geopolitical unit that encompasses the impact footprint. For example, if an impact footprint extends over a number of census tracts within the boundaries of a city, the COC is the city. If the impact footprint extends beyond the city limits and impacts the county, the COC is the demographic profile of the county. The data available for the COC demographic sample are limited to the governmental or geopolitical units for which census data are available (i.e., census tract, city, county).

The COC for the BMGR is considered to be the combined demographic profiles of Pima, Yuma, and Maricopa Counties—the three counties that portions of the BMGR encompass. These three counties total 23,824 square miles, of which the BMGR comprises 4,169 square miles or 17.5 percent. Based on U.S. Census Bureau data, the BMGR COC is 25.48 percent minority and 13.46 percent low income.

The only BMGR impact footprint that extends beyond the boundaries of Pima, Yuma, and Maricopa counties is socioeconomics. This impact footprint is measured in terms of the current contribution of the BMGR to the social and economic environment of the region. As such, the footprint encompasses the military installations that largely rely on the BMGR for training and the communities and counties that surround those installations. A separate COC is identified for the environmental justice analysis of this resource and is comprised of the combined demographics of Maricopa, Pima, Pinal, and Yuma counties in Arizona and San Diego County in southern California. The identified COC for socioeconomics is 29.77 percent minority and 12.47 percent low income.

Minority and Low-Income Populations

A minority is defined as an individual who is a member of the following population groups: American Indian or Alaskan Native, Asian or Pacific Islander, Black, or Hispanic (as reported by the U.S. Census Bureau).

Census data for Hispanics are usually reported as a total of persons of all races who identify themselves as Mexican, Puerto Rican, Cuban, Central American, or of other Hispanic origin or decent. The use of data that report the total persons of Hispanic origin could lead to double counting of an individual if, for example, a person was an American Indian of Hispanic decent. In order to avoid this misrepresentation, 1990 census data reported in the form of Hispanic origin by race were used to obtain the statistics for all census tracts and counties included in the analysis. Data reported in this manner differentiated the racial composition of persons who are not of Hispanic origin and persons of Hispanic origin. In census data reporting, there is also an “other race” category. These individuals are not considered minorities unless they are reporting Hispanic origin.

A minority population is identified where the minorities living in the affected area exceed 50 percent or are greater than the percentage of minorities in the COC.

A low-income population is defined as a community or group of individuals living below the poverty level. Poverty level statistics from the 1990 census data were used to determine low-income populations. These poverty statistics are based on the 1989 poverty level, which is considered to be an income of \$12,674 or less for a family of four. Low-income populations were identified wherever the percent of population below poverty in the affected area exceeded the percent below poverty in the COC.

4.16.3 Proposed Action

Noise

Under the proposed action, the existing noise conditions are expected to remain essentially the same. Noise effects are considered significant when the sound levels exceed those regarded as compatible for selected land use activities. As explained in Section 4.5, the benchmark noise level often applied to determine residential land use compatibility is an L_{dn} level of 65 dB. An L_{dn} of 55 dB is identified as a level that may be heard and perceived as annoying, but does not pose a risk to the public or its welfare. At L_{dn} values below 55 dB, the percentage of annoyance is correspondingly lower. Annoyance is never zero, but an L_{dn} of 45 dB or less is considered by most to be small enough to be negligible. The land area and population exposed to an L_{dn} of 65 dB and above provides the best measure for assessing noise impacts.

There are two census tracts outside of the BMGR affected by noise levels greater than 65 dB. One census tract is associated with operations at AUX-2 and the other is associated with operations at Gila Bend AFAF.

When compared to the demographics of the COC, the affected census tracts have a higher percentage of minority population and low-income populations than the COC (Table 4-8). These initial findings indicate that there may be environmental justice concerns; however, there are three major factors to consider before such a determination can be made. First, the census tracts affected by the noise levels, like many census tracts that cover rural areas, encompass larger areas and smaller populations than they do in urban areas. Second, only portions of each census tract are affected. Lastly, there must be residential areas in the affected areas in order to have an environmental justice effect.

65 dB Noise Contour	Census Tract	1990 Pop.	Total Minority	Percent Minority	Minority > COC	Total Low Income	Percent Low-Income	Low-Income >COC
AUX-2	Yuma County 114	5,159	4,494	87.11	Yes	1,677	32.50	Yes
Gila Bend	Maricopa	5,258	2,392	46.09	Yes	1,254	23.85	Yes

AFAF	County 7233							
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AUX-2 projected noise contours of 65 dB extend off range within Yuma County census tract 114. The affected area encompasses about 9 percent of the 141-square-mile census tract. Land uses in the affected area are primarily agricultural, but also include some industrial and residential uses (Southwest Division Naval Facilities and Command 1993). Efforts to contact local agencies for data that would help determine if higher concentrations of minority or low-income populations reside in the affected area versus the unaffected area revealed that no such data were available. Lacking these data, it must be assumed that the census tract provides an adequate representation of the population composition and poverty status of the affected residences.

According to the AICUZ study prepared for the Gila Bend AFAF, noise contours of 65 dB are projected to affect the Maricopa County census tract 7233 (AETC 1997). At 3,030 square miles, this is the largest census tract in Maricopa County. The area within the projected 65 dB noise contours encompasses less than one percent of the total census tract and includes one residence. No data were available to determine whether or not the population of the affected residence is minority or low income.

Socioeconomics

No adverse socioeconomic impacts would be expected with implementation of the proposed action, as there would be no expected changes to the operation and use of the BMGR. Therefore, military installations with missions supported by the BMGR would continue to operate at current levels for the foreseeable future, and current socioeconomic contributions to communities and counties surrounding the BMGR would continue.

4.16.4 Alternative Action

For both noise and socioeconomics, there are no differences from the conditions described for the proposed action.

4.16.5 No-action Alternative

Noise

Non-renewal of the range would result in a reduction in but not elimination of noise. The restricted airspace at the range could possibly be reconfigured and retained to support some continuing aerial training missions that do not require air-to-ground weapons training. It is also possible that the former range airspace could be converted to a MOA/ATCAA to support non-hazardous aerial training activities. If such a conversion occurs, the eventual lessening or cessation of military training (including supersonic training) in adjacent MOA/ATCAAs that

overlie populated areas, such as the Sells and Dome MOAs, would be likely. With the elimination of air-to-ground training, the potential for noise effects on low-income or minority populations would also be reduced or eliminated.

Socioeconomics

As discussed in Section 4.8.4, non-renewal of the BMGR is expected to result in military mission changes at Luke AFB, Davis-Monthan AFB, MCAS Yuma, and MCAS Miramar because these installations use the BMGR for a substantial amount of their aircrew training. The potential losses in employment, earnings, and total revenue associated with mission changes would be expected to significantly affect the communities that support these installations.

According to the socioeconomic model (Section 4.8.4), communities comprised of minority and low-income populations, and Indian tribes that would be potentially negatively impacted at a significant level by non-renewal of the range, include the following:

- # Avondale and El Mirage in Maricopa County
- # South Tucson and the Tohono O'odham Nation in Pima County
- # Somerton, San Luis, Ft. Yuma Quechan Indian Tribe, and Cocopah Tribe in Yuma County

There also are many communities that are not minority or low-income that would likely be adversely impacted. However, because of the uncertainty regarding the extent of mission changes, further socioeconomic environmental justice analysis would be premature. If non-renewal of the range led to substantial changes, documents separate from this LEIS would consider the specific environmental impacts of such events, including socioeconomic and environmental justice consequences. Therefore, although there could be potential for adverse impact to minority and low-income populations and Indian tribes with implementation of the no-action alternative, any such impacts would be determined by the required follow-on NEPA documentation.

4.16.6 Management Actions

In addition to the mitigation measures and management actions for noise discussed in Section 4.5.5, the LEIS public participation and outreach process will include efforts targeted towards providing these residences with access to information on, and participation in, matters relating to the noise effects of the range renewal.

4.17 UNAVOIDABLE ADVERSE ENVIRONMENTAL IMPACTS

Unavoidable adverse impacts (also referred to as residual impacts) are the effects that will still remain after mitigation measures have been applied. In some cases, unavoidable adverse impacts occur because there is no reasonable or effective mitigation to reduce the impact. In other cases, mitigation is not expected to be effective enough to reduce the level of impact to a low or negligible level. This section describes the unavoidable adverse impacts associated with either of the proposed action or alternative action to renew the BMGR, followed by the unavoidable adverse impacts associated with the no-action alternative. Resources with no unavoidable adverse effects are not included in this discussion.

4.17.1 Proposed Action and Alternative Action

Non-military Land and Airspace Use

As long as the BMGR remains withdrawn as a military reservation, land uses that are incompatible with the military mission would not be allowed on the BMGR. For example, mining, grazing, and agriculture are not authorized because of the risks associated with a live bombing and gunnery range.

Similarly, the need for restricted airspace to segregate high-speed, low-altitude maneuvering military aircraft for safety reasons prohibits civilian and commercial use of the airspace associated with the BMGR. These prohibitions cannot be avoided.

Noise

Unavoidable noise impacts result from routine aircraft operations on the BMGR. Most noise levels would be below the standard for compatibility with residential land use. However, noise levels from operations at AUX-2 and Gila Bend AFAF do exceed compatibility levels and would continue to do so as long as the military operates the auxiliary fields at current levels. Presently, the incompatible noise levels from AUX-2 affect a recreational vehicle park, part of a subdivision, and 13 dispersed residences located west of the auxiliary airfield. The incompatible noise levels from Gila Bend AFAF affect one residence located northwest of the auxiliary airfield. Residual impacts from noise are also discussed for recreation, biological resources, and environmental justice in this section.

Public Health and Safety

Military operations, including ordnance delivery, are hazardous in nature. Safety precautions (such as warning signs, fences, and access prohibitions) are designed to protect public health and safety and are the primary reason for withdrawing land that is not directly impacted. To the extent that the public heeds these protective measures, there is no unavoidable adverse impact to

public health and safety. However, individuals who ignore the safety precautions will continue to remain at risk.

Cultural Resources

It is possible mitigation will be adequate to result in non-significant residual impacts to cultural resources. Three potential situations for significant residual impacts exist, however: (1) a conclusion that the amount of data recovery possible in the near future will be inadequate to forestall the loss of substantial archaeological information within the tactical ranges in the eastern section of the BMGR; (2) a conclusion that adverse effects (as defined in the NHPA) to properties determined eligible for National Register listing under criteria A, B, or C cannot be materially reduced by the application of mitigation; and (3) the identification of TCPs or sacred sites within the BMGR and a conclusion by the traditional groups who value them that mitigation is impossible or inadequate. As the ICRMP is developed and related studies progress, a better understanding of whether or not any of these three possibilities is likely to occur will be obtained.

Visual Resources

For the duration of the land withdrawal, adverse visual impacts caused by military activities will continue in established training and target areas. Sporadic visual intrusion caused by aircraft overflights will also continue. While these impacts are expected to be adverse, they are not expected to cause substantial impact to the overall range landscape.

Recreation

Because of the safety risks in areas of the range used for air-to-ground training, recreation in certain parts of the BMGR would continue to be prohibited, restricting potential recreational opportunities. The sight and sound of aircraft overflights cannot be mitigated and is expected to be annoying to some recreationists who may be beneath a low-level flight corridor when an aircraft passes. This effect may be particularly prevalent with the Cabeza Prieta NWR and Wilderness where visitors may have expectation of quiet and solitude even though the wilderness is also within a military range. Low-level overflights of the Cabeza Prieta NWR and Wilderness are infrequent and generally limited to a few weeks per year, but these flights cannot be avoided.

Earth Resources

The continuation of military operations on the BMGR would result in continued physical ground disturbance from munitions impacts, roads, vehicle use, EOD clearance operations, ground

support areas, and target maintenance. This ground disturbance would continue to contribute to an increased potential for soil erosion and the development of cryptobiotic soils (also referred to as “moondust”) in some locations.

For the duration of the land withdrawal, mineral and geothermal energy development would continue to be precluded from BMGR lands. While this is an unavoidable effect associated with renewal of the land withdrawal, the effect is not irretrievable because these resources would remain available for future development in most places. However because of the intensive use of munitions, earth resource development may potentially be precluded even after expiration of the land withdrawal in some locations for safety reasons.

Water Resources

The physical ground disturbance associated with continued military operations on the BMGR may result in some potential for increase in sedimentation of downstream receiving waters as a result of the sediment on the BMGR that is transported by stormwater. In addition to sediment, there is some potential for stormwater and groundwater on the range to be contaminated by oils, lubricants, and fuels from motor vehicles used by the military on the BMGR as well as ordnance residues in the target areas. Finally, the land withdrawal could potentially preclude the development of on-range surface or ground water for off-range use.

Biological Resources

Unavoidable adverse impacts on vegetation on the BMGR are minimal due to the limited area affected by ground disturbing activities of all military activities on the BMGR. EOD clearance activities have the most extensive impact on vegetation. Grading to maintain target areas would also continue to result in removal of vegetation.

Unavoidable direct impacts to wildlife include potential mortality from ordnance delivery, destruction of burrows of small mammals and reptiles when grading, and collisions with vehicles. Aircraft overflights, ordnance delivery, and ground activities may cause disturbance to wildlife.

Potential adverse impacts including mortality, injury, habitat degradation, and disturbance were identified for the following special status species: Sonoran pronghorn, flat-tailed horned lizard, Cowles fringe-toed lizard, and Sonoran desert tortoise. None of these impacts are expected to jeopardize the continued existence of these species.

Environmental Justice

As long as (1) the projected noise levels from operations at AUX-2 and Gila Bend AFAP exceed standards for residential land uses; (2) residences are being impacted; and (3) those affected residences are categorized as having greater minority and low-income populations than the surrounding area, there will be an adverse environmental justice effect that cannot be mitigated.

4.17.2 No-action Alternative

With the no-action alternative, the BMGR would not be renewed. Initially, the lands would be segregated from other types of land uses and would be managed in accordance with the BLM Lower Gila South RMP Goldwater Amendment until the BLM could begin a new management planning process. Military operations would be phased out and a decontamination effort to remove military debris (such as expended ordnance) would be implemented.

It is anticipated that unavoidable adverse impacts may be associated with the decontamination process, but such effects cannot be accurately predicted until a decontamination plan is developed to outline the extent of clean-up and the processes that would be used. If the decontamination effort would involve ground disturbance, cultural and biological resources could potentially be adversely affected unless mitigation efforts are first implemented (such as surveying for cultural sites and conducting data recovery). These sorts of effects would need to be addressed as part of the decontamination plan.

Airspace and Range Operations

Unavoidable adverse impacts to airspace and range operations would result from the nation's reduced capacity for tactical aviation training. As the nation's second largest training range, non-renewal of the BMGR would be a long-term significant loss. At this time, no plans have been developed to address how training missions might be curtailed or moved; therefore, the extent of the impact cannot be measured.

Without the BMGR for tactical aviation training, several military installations that rely on the BMGR may be subject to mission changes. The loss of the investments made of the installations would also be an unavoidable adverse impact.

Socioeconomics

While the extent of impact cannot be measured, non-renewal of the BMGR would certainly affect the military installations that most heavily rely on the range for training missions. It is anticipated that substantial mission changes would occur at Luke AFB and 162nd ANG, and may also occur at WAATS, Davis-Monthan AFB, MCAS Yuma, and MCAS Miramar. The potential loss of jobs and the associated economic loss of the wages spent in the local economy would have an unavoidable adverse effect on several communities, but most notably the Arizona cities of Glendale, Litchfield Park, Youngtown, Surprise, Avondale, Goodyear, Peoria, Tucson, and South Tucson.

4.18 CONFLICTS WITH LAND USE PLANS, POLICIES, AND CONTROLS

Land use policies, plans, and controls include all types of formally adopted documents for land use planning, zoning, and related regulatory requirements, including formally proposed plans. The term “policy” includes formally adopted statements of land use policy inherent in laws and regulations, including formally proposed policies. Because the proposed action and alternative action involve renewing the military withdrawal of the BMGR and the no-action alternative would result in the entire BMGR withdrawal not being renewed, the primary focus of this discussion is on military and BLM plans, policies, and controls. In addition, land use plans, policies, and controls of lands immediately adjacent to the range were assessed to determine if conflicts would exist with any of the alternatives being considered.

Federal

On the federal level, land use plans, policies, and controls are associated with the primary land managers and administrators of the BMGR, including the BLM, Marine Corps, Air Force, and USFWS.

The Lower Gila South RMP Goldwater Amendment describes the management of the natural and cultural resources on public land within the BMGR. The Military Lands Withdrawal Act of 1986 (P.L. 99-606) assigns the BLM the responsibility for land and resource management on the BMGR, except for the 822,000 acres of the Cabeza Prieta NWR. The law also states that the management of all BMGR lands be consistent with military activities and managed pursuant to the Federal Land Policy and Management Act of 1976 (43 U.S.C. 1701 et. seq.).

The Lower Gila South RMP Goldwater Amendment also describes three ACECs within the BMGR. Management prescriptions for the Gran Desierto Dunes ACEC, Tinajas Altas Mountains ACEC, and the Mohawk Mountains and Sand Dunes ACEC include encouraging military ground training activities to remain within current use areas. The renewal alternatives presented in the LEIS would continue similar types of military training, and would therefore be in compliance with these management prescriptions. For the no-action alternative, there would be no change to the ACEC designation, although the management prescriptions for these areas would likely change as a result of discontinued military ground operations.

Although a Record of Decision has not yet been signed, an EIS has been prepared for actions proposed by MCAS Yuma for the Yuma Training Range Complex. The EIS analyzes alternatives to improve training procedures, develop training facilities, and reconfigure airspace. The renewal alternatives being considered in this LEIS would not affect the proposed action described in the YTRC EIS. The no-action alternative would essentially eliminate most, if not all, of the ground training procedures and facilities on the western portion of the BMGR.

The USFWS is responsible for managing the lands and resources of the Cabeza Prieta NWR. The USFWS retains a congressionally recognized and comparatively high level of autonomy and control over both military and non-military use of refuge lands. The agency is responsible for controlling public access and is largely responsible for public safety. The Air Force and Marine Corps require special use permits issued by the USFWS for any land use in the refuge not

specifically permitted by legislation or interagency agreements. The Draft Comprehensive Management Plan for the Cabeza Prieta NWR was released in 1997. The basic policy of the USFWS is to work cooperatively and, to the degree possible, collaboratively with the military agencies in accordance with P.L. 99-606 and the MOU of April 1994.

Implementation of either the proposed action or alternative action would not change management direction of the Cabeza Prieta NWR. Under the no-action alternative, the USFWS would continue to have surface management of the Cabeza Prieta NWR and the refuge would not be opened to entry under the mining laws or most other forms of appropriative land uses under the public land laws.

Immediately adjacent to the BMGR, federal lands are managed by the BLM Yuma Field Office, BLM Phoenix Field Office, and the National Park Service (Organ Pipe Cactus National Monument). Land use management prescriptions for the majority of federal lands north of the BMGR are described in the Lower Gila South RMP and EIS. The 1985 Yuma District RMP and EIS provides management prescriptions for six resource management issues: wildlife habitat, special management areas, grazing, land ownership, rights-of-way, and recreation. The Lower Gila South RMP and EIS focuses on rangeland management, wilderness, land tenure adjustments, and utility corridors. None of the alternatives being considered in this LEIS would be expected to have major effects on the elements of these RMPs.

The Final General Management Plan for Organ Pipe Cactus National Monument was completed and released in 1997. The primary goals described in the plan include adopting a regional perspective to improve visitor services and conserve resources, and to improve management capabilities to enhance visitor opportunities and protect resources and wilderness values. None of the alternatives being considered in this LEIS would be expected to have a substantial effect on the elements of this general management plan.

State

Arizona's statehood enabling legislation designated portions of each township as state trust land. The state's Urban Lands Act passed in 1981 has enabled the Trust to capitalize on the large increase that planning and zoning adds to raw land values. Most state trust lands in the vicinity of Yuma would be considered as urban lands and are thus available for lease or sale. Once the land is leased or sold to private interests, the potential for rezoning or variance requests increases, resulting in increased potential for development. Other state lands in the immediate vicinity of the range would not be considered urban lands and would therefore be less likely to be sold or exchanged.

Local

Local land management plans, policies, or controls in the vicinity of the BMGR include zoning ordinances, the Yuma Joint Land Use Plan, Gila Bend Master Plan, and Desert Spaces Plan for

Maricopa County. Land development along the perimeter of the range is controlled by zoning ordinances for Yuma, Maricopa, and Pima counties, and the cities of Yuma and Gila Bend. Current zoning of these lands would not conflict with any of the alternatives described in this LEIS.

The Yuma Joint Land Use Plan was prepared to (1) plan for compatible land uses in the vicinity of MCAS Yuma and (2) plan for other land uses meeting City and County of Yuma growth objectives within a study area that extends beyond the immediate airfield environment. The General Plan for the Town of Gila Bend depicts the desired land use patterns within the community's boundaries. Neither of the renewal alternatives would conflict with the plans for these communities. The no-action alternative could result in conflicts with the goals and objectives of these plans, however, depending on the level of potential effect at MCAS Yuma and the Gila Bend AFAF.

The Maricopa County Association of Governments has prepared a Desert Spaces Plan which identifies and recommends conservation and management strategies for natural resources and open spaces critical to the quality of life in Maricopa County. None of the alternatives being considered in this LEIS would conflict with the plan's recommended management plans and policies.

4.19 ENERGY REQUIREMENTS AND CONSERVATION POTENTIAL

The proposed action and the alternative action would not result in any discernible change in energy requirements compared to the energy currently used for military training operations on the BMGR. The withdrawn lands would continue to be reserved for the use by the military for an armament and high-hazard test area; training for aerial gunnery, rocketry, bombing, electronic warfare, and tactical maneuvering and air support; and other defense-related purposes. The most consumptive use of energy would continue to result from the fuel used to power the aircraft that train within the BMGR airspace. Fuel requirements for flight training would remain unchanged as a result of continued flight routes and procedures. Likewise, ground operations training would continue and would not result in changes in energy requirements other than the typical year-to-year fluctuations in training exercises. While the proposed and alternative actions would not be expected to increase energy requirements in the foreseeable future, they would also be unlikely to result in substantial energy conservation.

With the no-action alternative, the loss of BMGR lands would result in the elimination of most or all of the ground-based military training activities. While some air-to-air training missions could potentially continue, all air-to-ground training would be discontinued at the BMGR; thus fuel usage would be substantially less than that used for current BMGR training. The scale of operations at the BMGR is such that the loss of the range could have far-reaching effects on military bases and other ranges throughout the Air Force, Marine Corps, Navy, Army, ANG, ARNG, and Air Force Reserves. If certain training missions are canceled altogether, the no-action alternative could potentially result in energy conservation.

On the other hand, most of the training missions currently conducted at the BMGR would likely be executed at some other training range. It is presumed that aircrews and support personnel would be moved to other installations to be in closer proximity to open training ranges. While this LEIS does not speculate on the extent that operations would be moved to other installations or where those installations and training ranges might be, it is quite possible that aircrews and other support personnel would have to travel farther to access alternative training ranges. This could increase the amount of energy used compared to existing operations.

COMMITMENT OF RESOURCES

4.20 RELATIONSHIP BETWEEN SHORT-TERM USE OF THE ENVIRONMENT AND LONG-TERM PRODUCTIVITY

Short-term use refers to activities that would not continue for the life of the project. None of the military activities can be defined as short-term uses. Some activities, such as annual and 5-year EOD decontamination, are not continuous but would be repeated throughout the duration of the proposed action. Although there are no short-term uses, the proposed action does have effects on long-term productivity. Long-term productivity considers effects that persist for more than 10 years or for the life of the project activities. The proposed action would result in soil disturbance, loss or damage of vegetation and wildlife habitat, and visual and noise disturbance to wildlife throughout the duration of project activities. The majority of ground-disturbing military activities occur within already disturbed areas and are limited to a small portion of the BMGR. Effects of visual and noise disturbance on wildlife species on the BMGR are unknown, although studies on the effects of noise on Sonoran pronghorn are currently being conducted.

4.21 IRREVERSIBLE AND IRRETRIEVABLE

The proposed action and the alternative action both propose renewal of the BMGR to support continued military aviation training and associated support activities. Implementation of either of these action alternatives would require the continuing commitment of range land and airspace resources in support of that training. Some of these resources would be irreversibly and irretrievably committed to these actions at least for the life of the range renewal. For some resources the commitment would extend beyond the life of the range. The extent to which renewal of the BMGR would lead to irreversible and irretrievable commitments of resources is examined in the following subsections of this draft LEIS.

The no-action alternative proposes that the BMGR not be renewed and that military land use of the range cease. In the aftermath of terminating military use, new non-military uses of the former range lands outside of the Cabeza Prieta NWR would be identified and implemented. Some of these new usesXwhich eventually could include activities as diverse as mining, livestock grazing, or wilderness designationXcould also require irreversible and irretrievable commitments of resources. However, the extent to which non-renewal of the BMGR would lead to such resource commitments is not addressed in this draft LEIS because no meaningful forecast can be made as to what mix of non-military uses may occur or

where such uses may be located. An assessment of the irreversible and irretrievable commitments of resources associated with non-military reuse of a former BMGR would be included as a component of the FLPMA land use planning and NEPA documentation processes that would be required before new land uses could be implemented. The required land use planning and environmental assessment processes would be conducted by the BLM.

Irreversible commitment of resources for the purposes of this draft LEIS is interpreted to mean that once resources are committed, the action will continue to be committed and the production or use of those resources will be lost for other purposes throughout the life of the range renewal. An irretrievable commitment of resources defines those resources that are used, consumed, destroyed, or degraded during the life of the range that could not be retrieved or replaced during or after the life of the range.

4.21.1 Airspace

Renewal of the BMGR would provide continuing justification for retaining restricted airspace areas R-2301W, R-2301E, R-2304, and R-2305 for the life of the range. Designation of these airspaces as restricted would have to be irreversible and irretrievable for the life of the range if the BMGR is to continue to support live-fire training with aviation weapons. The use of these airspaces by civil aviation users would be controlled and greatly limited during the life of the range. The range airspace could be immediately retrievable for civil use without impediment following the future termination of the range and cancellation of the restricted airspace.

4.21.2 Military and Non-military Land Use

Renewal of the BMGR would constitute an irreversible and irretrievable commitment of the range area to support various military land uses for at least the life of the range. The proposed renewal would continue the statutory closure of the range lands for all forms of appropriative land use for the period of the land withdrawal. All other forms of non-military land use within the eastern and western range land sections would have to be compatible with the military purposes for which the range was reserved. The Cabeza Prieta NWR section of the range, which includes more than 95 percent of the refuge and nearly all of the Cabeza Prieta Wilderness, would continue to be used as a military overflight area, including low-level overflights along selected corridors, and a secondary safety buffer area for potential fallout of expended munitions or aerial targets. All other military use of the refuge section would continue to be limited to existing TACTS Range and GRMDS instrumentation sites.

The eastern and western range land sections underlying restricted airspace, which constitutes most of this area, would continue to serve as existing or potential secondary safety buffers for munitions impact (see Figure 2-1). Some non-military land uses could occur within these secondary buffer areas. A small portion of the eastern and western range sections located within the existing Air Force TAC or manned ranges or Marine Corps Moving Sands/Cactus West target complexes would continue to be committed for use as live-fire air-to-ground targets or as the primary safety buffers for these targets. Although not planned or foreseen at this time, additional areas of the range not currently used as targets or

primary safety buffers could be developed for this use during the life of the range to support emerging military training needs.

Termination of the range land withdrawal would result in the ending of the reservation of the range lands for military purposes, and its closure to appropriative land uses in order to support those purposes. Reopening of the former range lands for non-military reuse would have to await completion of new management planning under FLPMA and NEPA regulations but most of these lands could be retrieved for some type of reuse. Selected former target areas, however, may be so burdened by potential contamination from expended but unexploded ordnance that direct reuse of these locations would not be possible for safety reasons. The three HE Hill targets within the North, South, and East TAC ranges are examples of these types of locations. These types of sites may be irretrievably lost for reuse after the life of the BMGR. A decision not to renew or to cancel the range at some future time would trigger provisions within the withdrawal legislation for the DoD and DOI to identify such locations.

4.21.3 Noise

The noise environment of the BMGR would be irreversibly and irretrievably committed to exposure to noise from aircraft operations, vehicle or generator use, ordnance delivery and detonations, or other military operations over the life of the range.

4.21.4 Public Health and Safety

One of the principal purposes of the BMGR is to protect public health and safety. Renewal of the range would constitute a

continued irreversible commitment to that purpose for the life of the range. Operation of the range would not require any irreversible or irretrievable compromises of public health and safety during or after the life of the range.

4.21.5 Cultural Resources

Impacts to cultural resources ordinarily are thought of as irretrievable when physical disturbance occurs. Because of the large size of the BMGR and the limited amount of cultural resource survey completed for the range, some cultural sites could be subject to damage that results in an irreversible and irretrievable loss of the resource. Such inadvertent losses could occur for the life of the BMGR. While some cultural sites may be damaged from munitions impact, ground troop training, or EOD clearance, an even greater amount of damage would be anticipated with the no-action alternative as a result of decontamination efforts, assuming that decontamination activities would be more extensive than current EOD clearance practices.

In addition to physical disturbance, effects from visual or audible intrusions of cultural sites that are valued for more than their information potential would be regarded as irreversible for the life of the range. Such effects would occur only where the cultural site is subject to the intrusion, such as an aircraft overflight.

4.21.6 Socioeconomic Resources

The BMGR would be irreversibly and irretrievably unavailable for all forms of appropriative land use or other types of economic development during the life of the

range withdrawal. The range would become potentially available for non-military economic uses following the termination of the range.

4.21.7 Visual Resources

During the life of the range, visual resources would continue to be irreversibly and irretrievably degraded by military activities on range facilities, which constitute a small portion of the range, and by visual intrusions from aircraft operations. Target facilities, munitions impact areas, equipment/instrumentation sites, and administration and support areas could likely be reclaimed when the military discontinues use of them; however, no such discontinuations are forecast.

4.21.8 Recreation Resources

Recreation resources within the live-fire training ranges of the BMGR and within some safety buffer areas adjacent to these ranges would be irreversibly and irretrievably committed to limited, or in some circumstances, closed public access during the life of the range. Some former target areas that are contaminated with expended but unexploded ordnance could be irretrievably closed to recreation access for an indefinite period beyond the life of the range. These access limitations and closures are necessary to protect public safety and prevent interference with military operations.

4.21.9 Earth Resources

If contamination from unexploded munitions renders an area unsafe for future mining, there

could be an irreversible and irretrievable commitment of mineral resources associated with the renewal of the range. Since munitions have been used on the range since the early 1940's this potential already exists. However, the renewal of the range could cause additional unexploded munitions to accumulate and possibly exacerbate the effect.

4.21.10 Water Resource

Based on current levels of groundwater consumption needed to support military activities, and assuming that these levels of use do not exceed adjudicated water rights, there is no irreversible or irretrievable commitment of water resources associated with renewal of the range.

However, if contamination from unexploded munitions enters surface water or ground water resources, there could be an irreversible and irretrievable commitment or loss of water resources associated with the continued use of the range. The environmental fate of some of these chemicals is unknown, but some of them are known to contain hazardous constituents. Because of the depth to groundwater throughout most of the range, contamination of range groundwater resources is unlikely. Continuing decontamination practices should reduce the potential for loss of water resources due to chemical contamination.

4.21.11 Air Resources

The air quality of the BMGR would be irreversibly and irretrievably committed to some degradation from aircraft operations, vehicle or generator use, target construction and maintenance, ordnance delivery, or other military activities over the life of the range. The extent of the degradation would

be temporary, local, and nonsignificant, however, and would not involve the commitment of air resources beyond the life of the range.

4.21.12 Biological Resources

Wildlife would be subject to some levels of visual or noise disturbance from military operations for the life of the BMGR. The principal operations causing potential visual or noise disturbance of wildlife include aircraft overflights, ordnance delivery and detonations, vehicle use, generator operations, and troop deployments. These activities are widely dispersed and some occur on an infrequent basis. The potential severity of wildlife disturbance is widely variable and would depend on the wildlife species and location. Visual and noise disturbances of wildlife from military surface operations would end upon the termination of the range. No irretrievable damage to the health of any species population is foreseen during the life of the range. Some military use of the overlying airspace could continue after the life of the range, but that potential cannot be described with any certainty.

Direct mortality or injury of some wildlife from ordnance, vehicle, or laser use could occur during the life of the range. Affected individual animals would be irretrievably lost; however, no irreversible or irretrievable damage to the long-term health of any species population is foreseen.

Some damage or loss of perennial an annual vegetation and wildlife habitat is expected to take place due to military operations over the life of the range. However, by far most of the potentially damaging operations would continue to occur within existing use areas and at most locations the losses of

most types of vegetation and habitat would remain in balance with natural regeneration. No irreversible or irretrievable loses of vegetation or habitat would likely occur except in the locations described below.

In some locations, such as some core target construction or munitions impact areas or other built areas such as Gila Bend AFAF or AUX-2, an irreversible and irretrievable loss of perennial vegetation or habitat that extends beyond the life of the range could occur. These long-term losses could occur either because ordnance contamination at targets designated for live munitions is too extensive to safely permit reclamation efforts or because the affected soils could no longer support some types of vegetation or habitat. The extent of sites so affected is currently less than two percent of the range surface and would be expected to remain as a very small proportion of the total range area.

**5.0 ENVIRONMENTAL
EFFECTS OF THE SCENARIOS**

5.1 INTRODUCTION

Environmental effects predicted as a consequence of the scenarios (or sub-alternatives) associated with both the proposed action and alternative action are discussed in this chapter. As described in Chapter 2.0, Scenario A addresses military administration, Scenario B addresses the size of the land withdrawal, and Scenario C describes the administrative management of natural and cultural resources. In each set of scenarios, the first scenario results in the continuation of P.L. 99-606. In brief, the scenarios are:

Military Administration
Scenario A1: Air Force
administers entire military reservation

Scenario A2: Air Force and Marine Corps administer a split military reservation

Withdrawal Land Area

Scenario B1: Withdraw existing land area

Scenario B2: Withdraw a reduced land area

Administration of Natural and Cultural Resource Management

Scenario C1: Manage BMGR resources per existing P.L. 99-606 conditions

Scenario C2: DoD assumes the primary management role for lands outside the Cabeza Prieta NWR with DOI serving in an advisory management role

Scenario C3: Establish collaborative interagency management

5.2 AIRSPACE AND RANGE OPERATIONS

5.2.1 Military Administration

Scenario A1 would preserve the existing status of the range. No impacts to airspace or range operations would be expected as a result of implementation of this scenario.

Scenario A2 involves renewing the BMGR as two military reservations. One reserved for the use by the Secretary of the Air Force and the other for use by the Marine Corps through the Secretary of the Navy. Under this split administration scenario, the Air Force would continue to be the designated using and scheduling agency for the eastern land section of the BMGR and for the R2301E, R-2304, and R-2305 airspaces. The Marine Corps would for the first time be designated by Congress as the using and

scheduling agency for the western land section, and the R-2301W airspace. Currently, the Air Force has designated the Marine Corps as the using and scheduling agency.

This proposed administrative change, however, would have no effect on airspace or range operations. Routine Air Force and Marine Corps operations would continue to be unaffected. Integrated use of the entire BMGR to support training exercises such as the WTI course or other actions requiring concurrent scheduling of the airspaces would also be unaffected. The primary difference of this scenario compared to the single military reservation scenario is that management control authority and environmental compliance approval responsibility for military actions on the western portion of the range would be transferred to the Marine Corps. For all military actions taking place on the western section of the range, the Marine Corps would continue to comply with the NEPA, ESA, NHPA, and other applicable environmental compliance laws.

5.2.2 Withdrawal Land Area

The existing land area of the BMGR would be withdrawn under Scenario B1 and no changes to airspace and range operations would result.

The Sentinel Plain, Sand Tank Mountains, and the majority of the Ajo Airport areas (proposed for non-renewal with Scenario B2) are located outside of existing lateral limits of restricted airspace. As a result, no effects to existing airspace would be expected as a result of non-renewal of any or all of the three areas. A small portion of the Ajo Airport area being considered for non-renewal underlies the R-2305 restricted

airspace, but non-renewal of this land area would not affect military overflights. The current configuration of airspace structure in the vicinity of the Ajo Airport, which involves DoD, general aviation, and commercial air carriers, would continue.

Implementation of Scenario B2 would not be expected to change the overall effects to range operations. The Sentinel Plain area is currently managed by the Air Force to prevent unauthorized entry into Manned Range 4 and North TAC Range, and to exclude incompatible land use within

properties adjacent to these live-fire ranges. The access and encroachment control functions for which the Sentinel Plain area is used are important to the operation of the BMGR. Because the military activities at Range 4 and North TAC are expected to continue, some level of access and encroachment control would be required to continue under BLM management of the areas. With this condition in place, no effects on range or airspace operations would be expected to result from non-renewal of the Sentinel Plain area.

The Sand Tank Mountains area is similarly managed by the Air Force to prevent unauthorized access into East TAC Range and Manned Range 3 and to exclude land uses within the area that would be incompatible with low-level overflights associated with the entry and exit from East TAC Range and ordnance detonation noise from East TAC and Manned Range 3. Because military activities at east TAC and Manned Range 3 would continue, an appropriate level of access and encroachment control of this area would be required to continue under BLM management of the areas. With this condition in place, no effects on airspace or range operations would be expected from non-renewal of the Sand Tank Mountains area.

Lands in the vicinity of the Ajo area have no current military purposes. Therefore, non-renewal of this area would not affect range operations.

5.2.3 Administration of Natural and Cultural Resource Management

Scenario C1 would not affect the airspace or range operations.

Redefining the DoD's administrative responsibilities for natural and cultural resource management would not be expected to affect airspace or range operations in any negative way. Implementation of Scenario C2 would lead to the development of a new DoD resource management plan for the BMGR per Sikes Act regulations in which airspace and range operations would be incorporated as an integrated element. Some changes in these operations could result from the planning process but preservation of the military training mission would be a plan objective.

Scenario C3 also would not be expected to affect the airspace or range operations in any negative way. Establishing a collaborative interagency management framework to administer the natural and cultural resources within the range would lead to the development of a new resource management plan for the BMGR in which airspace and range operations would be incorporated as an integrated element. Some changes in these operations could result from the planning process but preservation of the military training mission would be a plan objective.

5.3 NON-MILITARY LAND AND AIRSPACE USE

None of the alternative scenarios for military administration, withdrawal land area, or the administration of natural and cultural resource management would have an effect on civil airspace structures or operations.

5.3.1 Military Administration

Because there would be no change to the current military administration of the range, no impacts to non-military land and airspace use would be expected as a result of implementing Scenario A1. Similarly, impacts to land uses along the perimeter of the BMGR would not be expected as a result of implementing this scenario.

The administrative split with the Marine Corps addressed in Scenario A2 would not result in impacts to non-military land use within or adjacent to the range or to civil airspace.

5.3.2 Withdrawal Land Area

With Scenario B1, the existing land area of the BMGR would be withdrawn. Impacts to non-military land uses within and adjacent to the BMGR and to civil airspace would be as described for the proposed action.

Under Scenario B2, non-renewal of the Sentinel Plain area would result in the land reverting to BLM administration, although some level of access and encroachment control would be required. The vast majority of the area being considered for non-renewal is within the Sentinel Plain Special Recreation Management Area. This management designation could remain, but public access would continue to be limited to periods when no military operations are scheduled because of the public safety risks associated with the land's proximity to the live-fire range. Non-renewal of this area would not result in impacts to lands adjacent to the range.

The Sand Tank Mountains area is currently managed by the Air Force to protect public safety and to exclude land uses that would be incompatible with low-level overflights and aircraft and ordnance detonation noise. Because military activities in the vicinity of East TAC would continue, some level of access and encroachment control of this area would be required even if this land were not renewed as part of the BMGR. All lands immediately adjacent to this area are currently BLM administered lands, used primarily for grazing. Not renewing this land area may result in some impact to the surrounding federal lands, especially in regard to grazing. By making these lands available for other purposes, grazing allotment boundaries and grazing practices could change. However, future use of non-renewed lands would be subject to BLM's public planning process.

Lands in the vicinity of the Ajo Airport that would not be renewed under this scenario would revert to BLM administration. Because of the area's proximity to Ajo, non-renewal of this area could lead to increased recreational use of the BLM lands. However, because of the relatively small size of this area and the fact that most of the adjacent land is already under BLM administration, there would likely be no impacts, with the possible exception of changing grazing allotment boundaries and grazing practices.

5.3.3 Administration of Natural and Cultural Resource Management

None of the scenarios that address the administration of natural and cultural resources on the range would be expected to have an impact on civilian airspace use or perimeter land use.

With regard to non-military land use, however, there are potential effects because selection of one of the scenarios would dictate which federal agency or agencies would be required to prepare resource and/or land management plan(s) for the eastern and western sections of the BMGR.

With Scenario C1, the DOI would be the designated land manager of the eastern and western sections of the BMGR. As such, the BLM would be responsible for producing a new resource management plan for the BMGR or continuing management in accordance with the Lower Gila South RMP Goldwater Amendment. If a new plan were developed, special non-military land management designations (such as ACECs, HMAs, and SRMAs) that were established in the Lower Gila South RMP Goldwater Amendment would receive special consideration and would likely be retained. However, the designations and the management prescriptions for these areas would be subject to review as to their appropriateness and effectiveness.

With Scenario C2, the DoD would be the designated land manager of the eastern and western sections of the BMGR. Thus, the military would produce a new resource management plan that considers not only military land and airspace uses, but also non-military land uses and natural and cultural resources. Like Scenario C1, existing special land management designations, including areas managed by the military for non-military use (Areas A, B, C, and D), would likely be given special consideration, but reviewed for their appropriateness and effectiveness. Although the military does not normally manage lands under BLM special land management designations (such as ACECs and SRMAs), other protective management designations could be applied and retained for existing ACECs, HMAs, SRMAs, and the proposed El Camino del Diablo Backcountry Byway.

Under the collaborative interagency land management scenario (C3), a new land management plan would be prepared under appropriate regulations with all specified collaborative agencies jointly responsible for plan development. Again, existing special designated and managed lands would likely be reviewed and given special consideration in the development of new management plans.

5.4 PUBLIC UTILITIES AND GROUND TRANSPORTATION

5.4.1 Military Administration

Neither Scenario A1 nor A2 would result in additional effects to public utilities and ground transportation within or adjacent to the range.

5.4.2 Withdrawal Land Area

With Scenario B1, the existing land area of the BMGR would be withdrawn. Impacts to public utilities and ground transportation within and adjacent to the BMGR would be as described for the proposed action.

Scenario B2 would result in one or more parcels of land not being included in the renewed land withdrawal. Because BLM has designated the Sentinel Plain area as a Special Recreation Management Area, it is likely that future requests for public utilities or ground transportation would be limited to existing corridors.

Future use of non-renewed lands in the Sand Tank Mountains area would be subject to BLM's public planning process. Potential utility or transportation corridors in this area may be considered, but would depend on the types of future land uses permitted on this land.

If lands in the vicinity of the Ajo Airport were not renewed, they would also be subject to the BLM's public planning process. The State Route 85 corridor would be unaffected and there would be no effect on the existing or proposed utilities within the utility corridor that parallels State Route 85. Proposals for transportation or utility corridors outside of those that currently exist would be subject to review based on the results of the public planning process for this parcel of land.

5.4.3 Administration of Natural and Cultural Resource Management

Scenarios C1 and C3 would not be expected to affect public utilities or ground transportation within or adjacent to the BMGR. The BLM would continue to review and process applications for transportation and utility systems and facilities on the range. However, with Scenario C2, DoD would take the lead role in administering natural and cultural resource management and the DOI would serve in an advisory role. While the DoD may request that BLM continue to review transportation and utility applications that are compatible with military operations, DoD could potentially assume this role with Scenario C2.

5.5 NOISE

5.5.1 Military Administration

Noise effects would be the same as that described for the proposed action regardless of whether the BMGR were administered by the Air Force alone or by both the Air Force and Marine Corps. Neither Scenario A1 nor A2 would affect the type of noise sources, the locations where noise occurs, or the amount of military operations.

5.5.2 Withdrawal Land Area

The land parcels proposed for non-renewal with Scenario B2 are not overlain by restricted airspace and no direct military operations occur on the ground. Therefore, there are no sources of military noise generated in these land areas and the noise effects would be the same as the proposed action regardless of whether Scenario B1 or B2 were selected.

The Sentinel Plain area and the Sand Tank Mountains area are currently managed primarily to prevent unauthorized access into high-use military target areas and to exclude land uses that might be incompatible with various forms of military training operations. For the Sentinel Plain area, average noise levels were identified as being less than 55 dB. The majority of the Sand Tank Mountains area also has average noise exposure levels of less than 55 dB. A small portion of the Sand Tank Mountains area and the entire Ajo Airport area have average noise exposure levels of 55-60 dB.

Under Scenario B2, non-renewed lands would revert to public lands administered by the BLM. As a result, no residential or other urban land uses would occur on these lands. Because average noise exposure levels are relatively low, other land uses that may eventually occur in these areas, such as dispersed recreation, would likely be considered a compatible use.

5.5.3 Administration of Natural and Cultural Resource Management

Military training activities on the BMGR and the associated airspace would not be affected by any proposed changes to natural and cultural resource management roles. As a result, noise effects would be the same as the proposed action regardless of the selection of Scenario C1, C2, or C3.

5.6 PUBLIC HEALTH AND SAFETY

5.6.1 Military Administration

Scenario A1 would result in no additional public health and safety concerns than that described for the proposed action.

Renewing the BMGR as a split military reservation (Scenario A2) would affect military administration of the range but would not change the public health and safety concerns that were described for the proposed action. In fact, in terms of public health and safety, the two sections of the range are effectively administered separately under the existing conditions. The Air Force and the Marine Corps are currently the designated and delegated military managers of the eastern and western sections of the BMGR, respectively. As such, these agencies have responsibilities to consider and protect public health and safety relative to their operations. This includes controlling all visitation to Marine Corps and Air Force operational sections of the BMGR in order to prevent interference with military operations and to ensure public safety.

5.6.2 Withdrawal Land Area

Scenario B1 would not result in additional impacts to public health and safety.

With Scenario B-2, any non-renewed lands would have to be evaluated for levels of contamination from explosive ordnance and toxic or hazardous materials before determining future land use. This evaluation would require DOI, in consultation with the Department of the Air Force, to determine if such decontamination is necessary, practicable, and economically feasible and what residual public health and safety risks may be present. Opening any areas for public use would not occur until the DOI prepares and publishes an order opening the lands to public access. In the long term, new management planning under FLPMA and NEPA regulations would need to be completed, and would provide direction as to the future management of these lands, including public accessibility.

For the Sentinel Plain and Sand Tank Mountains areas, access and encroachment control functions would be required so that safe and uninterrupted operation of the BMGR could continue. Public access to the BMGR would continue to be authorized only after completion of the permit process, which would include signing a hold harmless agreement. A BLM commitment of access control could occur through the language of the renewal legislation or some regulatory function.

5.6.3 Administration of Natural and Cultural Resource Management

Scenario C1 would retain current resource management responsibilities, and would not result in additional public health and safety impacts.

Military operations would continue and access and encroachment control functions performed by the DoD would not change with Scenario C2. Public access to the BMGR would not be affected because DoD already has the responsibility of controlling all range entry by military personnel and civilians. As a result, no additional impacts to public health and safety would be expected.

Like Scenario C2, proposed Scenario C3 to establish a collaborative interagency management team would not be likely to cause additional effects to public health and safety.

5.7 CULTURAL RESOURCES

5.7.1 Military Administration

With regard to consideration of cultural resources, there is virtually no distinction between Scenarios A1 and A2. Under the current condition (Scenario A1), the Marine Corps already assumes responsibility (on behalf of the Air Force) for management of cultural resources that may be affected by military actions on lands underlying R-2301W and the portion of the BMGR

underlying the Dome MOA. The only difference between the two scenarios would be that under Scenario A2, the Air Force would drop out as a signatory to MCAS Yuma's existing programmatic agreement for administration of the YTRC in Arizona and no longer be required to review and comment on MCAS Yuma's proposed undertakings. The BLM, Arizona SHPO, and Advisory Council on Historic Preservation (where specified by the programmatic agreement) would continue their involvement in review of proposed actions on the western section of the BMGR.

5.7.2 Withdrawal Land Area

Like the no-action alternative, adoption of Scenario B2 would necessitate decontamination efforts with the potential to disturb cultural resources to a greater extent than the current condition (Scenario B1). However, a decontamination plan has not yet been developed so the extent of potential disturbance to cultural resources cannot be determined at this time. Because control of access and encroachment still would be required in the Sand Tanks and on the Sentinel Plain, the potential for inadvertent or deliberate disturbance to cultural resources by recreationists and vandals probably would not differ much under either scenario.

5.7.3 Administration of Natural and Cultural Resource Management

With regard to cultural resources, Scenario C1, the current condition, is unduly complicated, poorly articulated, and leads to redundancies as well as potentials for the consideration of cultural resources to be overlooked in some situations. The latter occurs when agencies with proposed actions on the BMGR are unable to determine with which of the several "primary" land managers (Air Force, BLM or Marine Corps) they must coordinate. Voluntary coordination efforts are currently being explored with establishment of the BMGR Executive Council and development of the ICRMP. Thus some of these difficulties may be solved or at least partially resolved under Scenario C1. The structural problems inherent in the mandates of P.L. 99-606, however, would persist, with each agency answerable to divergent legal requirements and under distinct policy guidelines.

Scenario C2 would closely resemble the more typical federal administrative management set-up, with single agencies assigned primary responsibility for management decisions throughout lands under their jurisdiction. The USFWS would retain administrative responsibility for the Cabeza Prieta NWR, with the remainder of the BMGR administered either solely by the Air Force, or split into eastern and western sections administered by the Air Force and Marine Corps. The BLM's role would be advisory for the most part. Having a single administrator for given land areas would help to ensure proactive, responsible cultural resource management in keeping with the primary mission of the administrative agency.

Under Scenario C3, collaborative management would be mandated rather than voluntary. This scenario, however, apparently has no analogs in current practice. It is difficult to know how such an administrative set-up would affect cultural resource management because its effectiveness would depend on the structure of the collaborative framework. A benefit compared to Scenario

C1 would be that agencies would be working under common legal requirements and interagency responsibilities presumably would be more clearly defined. An additional benefit compared with Scenario C2 would be the opportunity to aggregate the expertise and historical understanding of cultural resource issues of multiple agencies. This may help to eliminate redundant data collection being done by more than one agency in a given area and help to ensure cultural resource concerns are being more fully addressed.

5.8 SOCIOECONOMIC RESOURCES

5.8.1 Military Administration

Scenario A1 would result in the same socioeconomic effects as described for the proposed action.

Scenario A2 would likely require the Marine Corps to increase its expenditures at MCAS Yuma to support its additional administrative responsibilities for the western section of the BMGR. However, these economic adjustments would not be expected to appreciably change the socioeconomic impacts on affected communities as described for the implementation of the proposed action.

5.8.2 Withdrawal Land Area

Socioeconomic effects with Scenario B1 would be the same as described for the proposed action.

Scenario B2 would not have any short-term socioeconomic impacts, but could possibly have long-term socioeconomic benefits. None of the three areas being considered for non-renewal currently support the operational capabilities of the military installations that train on the BMGR. Therefore, in the short term the impact of Scenario B2 would not differ from the proposed action.

If future land uses for these areas include livestock grazing, mining, or other income producing activities, socioeconomic gains could be realized in the long term. These effects would be evaluated during the land use management planning process for the non-renewed areas that would be required in accordance with FLPMA and NEPA.

5.8.3 Administration of Natural and Cultural Resource Management

None of the scenarios addressing the administration of natural and cultural resource management would differ from the socioeconomic effects described for the proposed action.

5.9 VISUAL RESOURCES

5.9.1 Military Administration

In terms of visual resources, there would be no change in effects resulting in the implementation of the proposed split administration of the range (Scenario A2) versus administration of the range under the existing P.L. 99-606 conditions (Scenario A1).

5.9.2 Withdrawal Land Area

The potential visual resource impacts of Scenario B1 would be the same as those described for the proposed action. However, non-renewal of portions of the BMGR (Scenario B2) could potentially have additional effects on visual resources. The areas proposed for non-renewal include Air Force Management Area A, the portions of Sentinel Plain north of the restricted airspace boundary, and the area around the Ajo airport south of the restricted airspace boundary. Implementation of this scenario would have consequences for the areas not included in the withdrawal similar to the impacts described for the no-action alternative. Dependent upon new land management planning, these lands may be opened to some or all forms of appropriate use such as mining or livestock grazing. The introduction of new land uses into any of the three areas proposed for non-renewal could potentially modify the natural landscape. These effects would be addressed in separate NEPA documentation addressing the new types of land use that may be proposed.

Of the portions of the range that are being considered for non-renewal, the effects to visual resources could potentially change the most in Area A. Virtually all of Area A is identified as having Class A scenic quality and high visual sensitivity. Modifications to the area are minimal and include recreation use roads, historic mines and wells, and scattered relic military debris. Under the Lower Gila South RMP Goldwater Amendment, Area A is managed under interim Class II and Class III management objectives. These management classes would remain in place until final classifications are made or a new RMP is developed.

The portion of Sentinel Plain being proposed for non-renewal is of high visual sensitivity and Class B scenic quality. Under the Goldwater Amendment, this area is managed under Class II visual resource management objectives. The portions of the Sentinel Plain area being proposed for non-renewal do not overlap the interim Class IV North TAC and Range 4 areas. With implementation of this scenario, the BLM would continue to manage the non-renewed area in Sentinel Plan as Class II until final VRM classifications are determined or a new RMP is developed.

The area around the Ajo Airport is currently managed by the BLM under interim Class III VRM objectives. The area displays Class C scenic quality and is likely to be low to moderate sensitivity. Although this area surrounds the Ajo Airport and Country Club, modifications to the BMGR area proposed for non-renewal are minimal. New management planning for this area would likely be influenced by the proximity of the lands to other developed areas. But until new resource management planning is developed, no effects can be speculated.

5.9.3 Administration of Natural and Cultural Resource Management

Under Scenario C1, BLM would retain responsibility for the administration of the VRM for the BMGR under the Lower Gila South RMP Goldwater Amendment and any updates to the RMP.

Under Scenario C2, BLM would likely remain involved in the management of visual resources, but would serve in an advisory role to the military departments. Military resource management plans would be developed under Sikes Act regulations in cooperation with the Department of the Interior. The management of visual resources would be more closely integrated with the management of military operations and land use.

Because of its expertise in visual resource management, BLM would be presumed to continue to have important involvement with VRM on the BMGR with Scenario C3. The type and extent of BLM administration of visual resources would be dependent upon the collaborative interagency framework that would be determined following the selection of this scenario by Congress. The interagency collaborative nature of Scenario C3 may result in better planning of military operations in regard to the visual setting and proximity to sensitive viewpoints.

5.10 RECREATION

5.10.1 Military Administration

Neither Scenario A1 nor A2 would change current military operations, so public access to the BMGR would remain unchanged from existing conditions. Recreational opportunities would be the same as for the proposed action.

5.10.2 Withdrawal Land Area

Scenario B1 would have no effect on recreation resources. Public access procedures to the range would not change, and existing opportunities for recreation on the BMGR would continue.

With the implementation of Scenario B2, the primary change in the effects to recreation as described for the proposed action relate to the non-renewal of Area A in the Sand Tank Mountains area. Of the two areas where recreation access to the eastern section of the BMGR is routinely granted under Air Force permit, Area A provides a greater variety of recreational

opportunity and receives higher levels of visitation. Under Scenario B2, this area would no longer be a recreation area managed by the Air Force as it is under the proposed action. The Air Force and BLM would work together to establish a clear boundary for the public to reduce encroachment and prevent unauthorized access into East TAC and Manned Range 3. The BLM would solicit public input, consider a variety of land uses that provide access and encroachment control, and develop a long-term plan under NEPA and FLPMA. Recreation would not necessarily become the sole future land use for this area, but is expected to continue to be an important land use.

The non-renewal of lands in the Sentinel Plain area could also change the effects to recreation as described for the proposed action. The Sentinel Plain area is currently managed by the Air Force to provide access and encroachment control and prevent unauthorized entry into Manned Range 4 and North TAC. Public access to the area is limited to the few times when no military operations are scheduled. There are opportunities for recreation in the area. In fact, most of the area proposed for non-renewal is within the BLM designated Sentinel Plain SRMA. As with Area A, the BLM would consider a variety of land uses for the non-renewed portions of the Sentinel Plain area, as long as such uses provide access and encroachment control. Recreation is among the land uses that would likely be considered.

The non-renewal of lands in the vicinity of the Ajo Airport would not likely result in a change to recreation compared to that described for the proposed action. These lands would likely have little recreation potential because of their limited size and proximity to the Ajo Airport and other developed lands.

5.10.3 Administration of Natural and Cultural Resource Management

Recreation resources would not be affected by Scenarios C1, C2, or C3. All existing recreation, protection, and special resource conservation areas within the BMGR (including ACECs, SRMAs, HMAs, and the El Camino del Diablo) would be retained. Public access to the BMGR would not be expected to change; DoD would retain the responsibility of controlling range entry by military personnel and civilians through the existing permit system.

5.11 HAZARDOUS MATERIALS AND WASTE

5.11.1 Military Administration

Scenario A1 would not change the impacts to hazardous materials or waste management as described for the proposed action.

If the military reservation is split between the Air Force and the Marine Corps as proposed in Scenario A2, the administration of hazardous materials and waste management on the BMGR would be affected. Currently, the Marine Corps assumes responsibility (on behalf of the Air Force) for all Marine Corps hazardous materials and waste activities on the western section of

the BMGR. To regulatory agencies such as the EPA and ADEQ, however, the Air Force is considered the “owner/operator” of the BMGR and is, therefore, ultimately responsible for Marine Corps hazardous material and waste activities on the BMGR.

Under Scenario A2, the Air Force would no longer be responsible for Marine Corps hazardous materials and waste activities on the western BMGR. A specific example of how this will represent change from the current situation is that MCAS Yuma, rather than Luke AFB, would be responsible for the interim ADEQ RCRA Part B permit for the Marine Corps’s open burn/open detonation facility on the western BMGR.

Aside from administrative differences, the impacts associated with the implementation of Scenario A2 are not expected to diverge appreciably from those described for the proposed action because hazardous materials and waste management under Air Force and Marine Corps guidance is rather uniform. This uniformity is also derived from the fact that the Air Force and Marine Corps both currently comply with the same applicable laws and operate in a manner that minimizes or eliminates the use of hazardous materials and the release of pollutants into the environment.

5.11.2 Withdrawal Land Area

With Scenario B1, the existing land area of the BMGR would be withdrawn, resulting in the same hazardous waste effects as described for the proposed action.

Non-renewal of one or all of the three portions of the BMGR under consideration with Scenario B2 would necessitate the determination of the extent of contamination of these parcels before establishing future land use. Like the no-action alternative, it would be necessary to determine if decontamination of explosive, toxic, or other hazardous materials is necessary, practicable, and economically feasible for the lands not included in the renewed withdrawal. The environmental impacts associated with proposed decontamination activities cannot be determined until a decontamination plan is developed to determine the process and extent of decontamination activities.

DOI, in consultation with the Department of the Air Force, would be responsible for determining future land use and the Department of the Air Force would be responsible for decontamination to the extent that funds are appropriated for such purpose.

5.11.3 Administration of Natural and Cultural Resource Management

None of the scenarios addressing the administration of natural and cultural resource management would change the hazardous materials and waste impacts as described for the proposed action.

5.12 EARTH RESOURCES

5.12.1 Military Administration

Impacts to earth resources would be similar regardless of whether the BMGR is administered entirely by the Air Force (Scenario A1) or whether the Marine Corps assumes administrative responsibility for the western section of the BMGR (Scenario A2). Military activities would remain generally the same and natural resource management practices would continue as required by environmental legislation including NEPA, FLPMA, the Sikes Act, and P.L. 99-606. Surface management by the BLM would continue for the eastern and western sections. The USFWS would continue as surface management administrators of the Cabeza Prieta NWR section.

5.12.2 Withdrawal Land Area

Scenario B1, renew the existing BMGR withdrawal land area, would have the same impacts as described for the proposed action.

Under Scenario B2, there are three parcels of land that may not be included in the renewed BMGR land withdrawal. The non-renewed lands would be managed by the BLM. P.L. 99-606 provides that because of potential contamination by expended munitions or other materials, several actions would need to occur before the Air Force relinquishes any of these land parcels to the Department of the Interior. BLM management would be according to FLPMA and NEPA regulations. Potential future development may include copper and wollastonite (mineral that may be used as a filler for paint or in refractory ceramics) in the Sand Tank Mountains and geothermal resources could be developed in the Sentinel Plain, depending on resource abundance, need, and value. Development of mineral or energy resources is also dependent on factors such as biological and cultural resource issues.

Erosion hazard potential of the soils is slight in these parcels so increased public use, based on BLM management plans, should have minimal impact.

5.12.3 Administration of Natural and Cultural Resources Management

Under Scenario C1, there would be no change to earth resources from the current conditions or the proposed action. Scenario C1 continues the existing division of management responsibilities among multiple agencies.

Under Scenario C2, DoD would administer the management of natural and cultural resources for the eastern and western sections of the BMGR and USFWS would continue to manage the Cabeza Prieta NWR. Under Scenario C3 a collaborative interagency management framework would oversee resource management of the BMGR. Because of the continued adherence to federal, state, and local regulations, including NEPA, the Sikes Act, and FLPMA, that there will be no significant changes to earth resources under Scenarios C2 or C3 in comparison to the proposed action.

5.13 WATER RESOURCES

5.13.1 Military Administration

Impacts to water resources would be similar regardless of whether the BMGR is administered entirely by the Air Force (Scenario A1) or whether the Marine Corps assumes administrative responsibility for the western section of the BMGR (Scenario A2). Military activities would remain generally the same and natural resource management practices would continue as required by environmental legislation including NEPA, FLPMA, the Sikes Act, and P.L. 99-606. Surface management by the BLM would continue for the eastern and western sections. The USFWS would continue as surface management administrators of the Cabeza Prieta NWR section. Water resources would continue to be subject to federal, state, and local rules and regulations that protect water quality and ownership of surface water rights and groundwater permits.

5.13.2 Withdrawal Land Area

Scenario B1, renew the existing BMGR withdrawal land area, would have the same impacts as described for the proposed action.

Under Scenario B2, up to three parcels of land may not be included in the renewed land withdrawal. The lands would be administered in accordance with BLM management. P.L. 99-606 provides that because of potential contamination by expended munitions or other materials, several actions would need to take place before the Air Force relinquishes any of these land parcels to the Department of the Interior. BLM management would be according to FLPMA and NEPA regulations.

With non-renewal of the three parcels—Sand Tank Mountains, Sentinel Plain, and Ajo Airport—the Air Force would also convey water rights for these parcels (Table 5-1). One adjudication claim occurs at Sentinel Plain for one acre-foot (325,851 gallons) annually of groundwater at a windmill. There are no adjudication claims at Ajo Airport. There are 15 adjudication claims in the Sand Tank Mountains parcel, which include 6 acre-feet (one acre-foot from each of six groundwater wells for a total of approximately 1.96 million gallons) along with an additional 180,000 gallons annually among nine artificial and natural catchments. Relinquishment of these water rights should not affect current or future water consumption requirements on the BMGR. None of the wells or surface water catchments supplies water for domestic use except for at the specific locations. If the area is not renewed and no longer used by the DoD, the water resources may be available for future local use. The artificial and natural catchments are for wildlife use.

TABLE 5-1 SUMMARY OF ADJUDICATION CLAIMS AFFECTED BY SCENARIO B2			
Claim No.	Source	Name	Annual Withdrawal
	<i>Sentinel Plains</i>		

37383	groundwater	Stamps Windmill Well	1 acre foot
<i>Sand Tank Mountains</i>			
37456	artificial catchment	catchment #5	20,000 gallons
37438	natural catchment	Pothole	20,000 gallons
37395	groundwater	Johnson Windmill Well	1 acre foot
37455	artificial catchment	catchment #6	20,000 gallons
37457	artificial catchment	catchment #4	20,000 gallons
37394	groundwater	Javalena Well	1 acre foot
37382	groundwater	Javalena Well	1 acre foot
37392	groundwater	Sand Tank Well	1 acre foot
37432	artificial catchment	Windmill & Fence	20,000 gallons
37393	groundwater	Sand Tank Windmill	1 acre foot
37460	artificial catchment	catchment #2	20,000 gallons
37437	artificial catchment	catchment #9	20,000 gallons
37388	groundwater	Raleigh Well	1 acre foot
37459	artificial catchment	Mesquite Spring	20,000 gallons
37461	artificial catchment	catchment #1	20,000 gallons
1 acre foot = 325,851 gallons			

5.13.3 Administration of Natural and Cultural Resources Management

Under Scenario C1, there would be no change to water resources from the current conditions or the proposed action. Scenario C1 continues the existing division of management responsibilities among multiple agencies.

Under Scenarios C2 and C3, there would be changes in resource management administrators. Under Scenario C2, DoD would be responsible for administering management of natural and cultural resources except within the Cabeza Prieta NWR where the USFWS would continue. Under Scenario C3 a collaborative interagency management framework would oversee the BMGR. Because of the continued adherence to federal, state, and local regulations, there will be no significant changes to water resources under Scenarios C2 or C3 in comparison to the proposed action.

5.14 AIR QUALITY

5.14.1 Military Administration

Both Scenarios A1 and A2 would result in the same air quality impacts as those described for the proposed action as these scenarios would not change military operations from existing conditions.

5.14.2 Withdrawal Land Area

No military operations within the existing BMGR boundary or the associated airspace would change with Scenario B1. Therefore, air quality impacts would be the same as that described for the proposed action.

No direct military operations occur within any of the three parcels of land being considered for non-renewal with Scenario B2. Consequently, the air quality impacts from military operations would be the same as that described for the proposed action.

With Scenario B2, the non-renewed lands would revert to public lands administered by the BLM. Opening these lands for other land uses would not occur until the Department of the Interior prepares and publishes an order opening the lands to public access. New management planning under FLPMA and NEPA regulations would need to be completed, and would provide direction as to the future management of these lands. Because the Sentinel Plain area and the Sand Tank Mountains area would continue to be managed for access and encroachment control, it is unlikely that potential land uses within these areas would result in significant air quality impacts.

5.14.3 Administration of Natural and Cultural Resource Management

Military training activities on the BMGR and the associated airspace would not be affected by any proposed changes to natural and cultural resource management roles. As a result, air quality effects would be the same as the proposed action regardless of the selection of Scenario C1, C2, or C3.

5.15 BIOLOGICAL RESOURCES

5.15.1 Military Administration

Impacts to biological resources would be similar regardless of whether the BMGR is administered entirely by the Air Force or whether the Marine Corps assumes the administrative responsibility for the western section of the range. Military activities would remain the same, as would natural resource management practices as required by environmental legislation including the Sikes Act, ESA, and NEPA.

5.15.2 Withdrawal Land Area

Scenario B1 would have the same biological effects as those described for the proposed action.

Under Scenario B2, the parcels of land that may not be included in the renewed withdrawal would initially be managed in accordance with the BLM Lower Gila South RMP Goldwater Amendment. BLM would initiate a public planning process to determine the future use of these lands. Effects to biological resources would be further evaluated in that planning process after

proposed land uses are identified. Potential future uses may include wilderness, mining, livestock grazing, or recreation.

Of the three areas being considered for non-renewal, the Sand Tank Mountains area is most valuable in terms of biological resources. This area contains Arizona upland desert vegetation with the highest density of saguaros on the BMGR. Vegetation characteristics are suitable for foraging lesser long-nosed bats, which have been observed in the area (Dalton et al. 1994). The Sand Tank Mountains support a relatively large population of Sonoran desert tortoise compared to other mountains on the BMGR (Dames & Moore 1996). In the absence of a military withdrawal, certain types of land uses (such as mining and livestock grazing) may be detrimental to these biological resources. These activities, however, would not take place without a full environmental review.

5.15.3 Administration of Natural and Cultural Resource Management

Scenario C1 is a reflection of the current condition, which is characterized by the overlapping resource management responsibilities of multiple agencies. The USFWS manages the Cabeza Prieta NWR, but also has a role in the entire BMGR in regulating the implementation of the ESA. For the portion of the BMGR that is outside of the Cabeza Prieta NWR, the BLM is responsible for developing and implementing land management plans, including habitat management plans. The live-fire ranges on the eastern land section of the BMGR limit access and preclude routine BLM management. The BLM is more active in managing habitat on the western land section of the range where it has routine management access. The Air Force also has an important role in managing biological resources within the eastern land section of the range through compliance with the ESA, the Sikes Act, and other applicable environmental regulations. Through its compliance responsibilities, the Air Force has initiated numerous biological studies and surveys, which have contributed to a better understanding of the biota and its

management requirements. Similarly, the Marine Corps also serves as an active resource manager through compliance with environmental laws and regulations. The Marine Corps is a participant in the working group of the flat-tailed horned lizard interagency coordinating committee. Because military operations are the single predominant land use of the BMGR, the management efforts of the DoD offer a substantial contribution to biological resource protection.

As noted in Chapter 2.0, the division of management responsibility among multiple agencies has led to confusion as to which agency is responsible for some aspects of biological resource management. Consequently, some management efforts are redundant and some resource management opportunities and needs are overlooked. Scenario C1 would continue the existing division of management responsibilities among multiple agencies.

A single agency (DoD) would be responsible for ensuring management of biological resources outside of the Cabeza Prieta NWR under Scenario C2. The USFWS would continue to be responsible for the Cabeza Prieta NWR. The principle benefits of Scenario C2 are two-fold. First,

single agency management would end the confusion of the multiple agency structure. Second, DoD, through the Air Force and Marine Corps, is in a position to incorporate military operations as an integrated land use component in natural resource and habitat management plans. The integrated approach is more effective for striking an appropriate balance between land use and resource conservation needs.

Scenario C3 would mandate a collaborative interagency management approach. Compared to Scenario C2, a benefit of collaborative interagency management is that the expertise and resources of multiple agencies are pooled. In addition, keeping all agencies involved better retains the historical understanding of biological projects completed in the past by the various agencies and academic researchers. With DoD involvement, the knowledge of military needs and the influence to adjust training exercises or their locations is available. The effectiveness of a mandated interagency team would be dependent on the structure of the collaborative framework. While this effectiveness cannot be forecast, agencies would be able to work under common legal mandates and with a clearly defined set of interagency responsibilities.

5.16 ENVIRONMENTAL JUSTICE

Because none of the renewal range management scenarios are expected to result in significant adverse impacts to the environment, no environmental justice impacts are associated with the renewal scenarios.

6.0 CUMULATIVE EFFECTS

Cumulative effects are those additive or interactive effects that would result from the incremental impact of the proposed action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Interactive effects may be either countervailing—where the net adverse cumulative effect is less than the sum of the individual effects—or synergistic—where the net adverse cumulative effect is greater than the sum of the individual effects.

During public and agency scoping processes for this draft LEIS, concerns were expressed that a number of actions in the BMGR area would cause cumulative effects, particularly for biological resources. In the subsections that follow, actions that may have cumulative effects are described in general terms. Specific discussions of potential cumulative effects on each resource follows.

6.1 POTENTIAL CUMULATIVE EFFECT ISSUES

Aside from military training, primary land uses within the BMGR include recreation, international border surveillance, utility rights-of-way, and natural and cultural resource management. Many of the specific users, user activities, existing facilities, plans, or proposals for non-military land use activities were identified as key potential cumulative effect issues and are, therefore, described in detail under separate subheadings.

The BMGR is located in an area that has experienced a trend of historical population growth that is projected to continue. The three counties that the BMGR lies within cover a combined area of 23,923 square

miles, or 21 percent of the 113,642 square miles in the state of Arizona. In the 15-year period from 1980 to 1995, the combined populations of these three counties increased by about 32 percent and are projected to increase by 25 percent in the 15 years between 1995 and 2010 (see Table 3-16). By comparison, the population of the state of Arizona increased by about 35 percent from 1980 to 1995 and is projected to increase by about 27 percent from 1995 to 2010. The population of the United States increased by about 13 percent from 1980 to 1995 and is projected to increase by about 12 percent from 1995 to 2010. In 1997, the U.S. Census Bureau ranked Arizona as the second fastest growing state (U.S. Census Bureau 1997).

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, military training, and various areas designated for recreation, protection, or conservation. Population centers in the vicinity of the range include the larger communities of Yuma, Gila Bend, Casa Grande, and Ajo; smaller communities are primarily located along principal transportation routes. The BMGR is bordered by Mexico on the south.

The primary administrator of lands in the vicinity of the BMGR is the BLM. BLM lands are found to the west, north and east of the BMGR. Arizona State Trust lands are distributed throughout the area north of the range in the Yuma area, along the Gila River, and near Gila Bend. The Tohono O'odham Nation is located directly east of the range; the Gila Bend Indian Reservation is located to the northeast. Bureau of Reclamation administered lands are located south of Yuma, along the Mexico border,

and along the Gila River north of the range. To the north of the BMGR, the Yuma Proving Ground is a large military reservation used by the U.S. Army.

Much of the area surrounding the BMGR is formally designated for some level of recreation, protection or conservation. The largest of these areas includes two national wildlife refugesXXkofa and Cabeza PrietaXand Organ Pipe Cactus National Monument. The majority of land within these three areas has been designated as Wilderness. Other designated Wildernesses are distributed throughout the area and include:

- # Trigo Mountains Wilderness
- # Imperial NWR Wilderness
- # Muggins Mountains Wilderness
- # New Water Mountains Wilderness
- # Eagletail Mountains Wilderness
- # Signal Mountains Wilderness
- # Woolsey Peak Wilderness
- # North Maricopa Mountains Wilderness
- # South Maricopa Mountains Wilderness
- # Table Top Wilderness
- # Sierra Estrella Wilderness

6.1.1 Phelps Dodge Ajo Incorporated Mine

The Phelps Dodge Corporation proposes to resume mining operations at its Ajo, Arizona property in 1998. The Phelps Dodge Ajo Incorporated Mine (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 368

employees, and invest \$240 million in modernization of its pit and ore milling equipment. Phelps Dodge estimates the annual production at the Ajo site at 135 million pounds of copper and 25,000 ounces of gold. The operation's mineral reserves are expected to last just over 10 years.

As part of the proposed mining operations in Ajo, the historic Tucson, Cornelia, and Gila Bend Railroad would be upgraded for use during the construction and operation of the mine to haul concentrate when the concentrator is in operation.

6.1.2 Gila Bend to Ajo 230kV Transmission Line Project

The Ajo Improvement Company, a subsidiary of Phelps Dodge Corporation, is applying for a right-of-way grant for the construction and operation of a 230 kilovolt (kV) transmission line from Gila Bend to Ajo. The PDAI Mine is planning to reopen the Ajo mine and, as a result, has identified the need for additional electrical power requirements. The proposed transmission line would provide economical and reliable power for copper ore mining, milling, and concentrating operations at the mine.

Specifically, the line is being proposed from the Gila Bend Substation on the west side of Gila Bend, roughly paralleling the existing Arizona Public Service Company Gila Bend to Ajo 69kV transmission line and Arizona State Route 85 to a proposed substation that would be located near the PDAI Mine on the southeast side of Ajo, Arizona.

Except for lands in the vicinity of Gila Bend and Ajo, the transmission line would pass through the BMGR. The Ajo Improvement Company is requested a BLM

right-of-way grant to construct, operate, and maintain this transmission line. The right-of-way requested is 100 feet wide and approximately 47 miles long, primarily within existing BLM utility corridors. The transmission line would be constructed using primarily single wooden pole structures that are about 82 feet high and spaced approximately 500 feet apart.

6.1.3 Yuma Area Service Highway

The Yuma Area Service Highway has been proposed by the Yuma Metropolitan Planning Organization to connect Interstate 8 and Business 8 with the City of San Luis and a new commercial port-of-entry east of San Luis at Avenue E. This proposed highway would be approximately 25 miles in length and would improve the transportation of trade and freight between the United States and Mexico. A portion of the most recent alignment being considered would be located on the westernmost portion of the BMGR, although 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.

6.1.4 Improvements to State Route 85

The Arizona Department of Transportation has proposed to upgrade a portion of State Route 85 about 10 miles north of Ajo. This upgrade involves the widening of the roadway to improve safety through the Crater Range area for a distance of about 3 miles. Project construction is scheduled for summer 1998.

6.1.5 NAFTA Related Developments

The North American Free Trade Agreement (NAFTA) was authorized in 1995. Although it remains unclear what this might mean to land use patterns, NAFTA holds considerable economic promise for the states strategically located on major trade corridors. Arizona and Sonora share such prime locations. Overall, the effects of NAFTA are expected to create increased traffic from each port-of-entry and along each of the border routes to and from Mexico into the United States. NAFTA is likely to result in continuing increases in commercial truck and passenger vehicle traffic, creating a greater need for road improvements, including reconstruction, resurfacing, and widening. State Route 85, Interstate 8, and the proposed Yuma Area Service Highway are the principal routes within the study area that would be affected.

6.1.6 San Luis Port-of-Entry

A related development to the Yuma Area Service Highway is the proposed relocation of the San Luis commercial port-of-entry approximately four miles east of its present site. This relocation is supported by officials in Sonora and Arizona. Growth in port activity at San Luis is due to a general increase in trade between the United States and Mexico and rapid population growth at the border. San Luis Rio Colorado, Sonora (across the border from San Luis, Arizona) has a metropolitan population of approximately 200,000 and is one of Mexico's fastest growing urban areas. An additional impetus for the commercial port's relocation is the planned major industrial park (Parque Industrial Internacional) to be constructed to the east of San Luis Rio Colorado, Sonora.

6.1.7 Parque Industrial Internacional

The Mexican government has granted approval of Parque Industrial Internacional, a major (8,000 acre) industrial park to be located four miles east of San Luis Rio Colorado in Sonora. This development reinforces the desire to relocate the San Luis commercial port of entry approximately four miles to the east of its present location.

6.1.8 Improvements at Childs Mountain

The FAA released an EA and Finding Of No Significant Impact in February 1998 as part of its national program to modernize the Joint Use En-route Radar Systems along the perimeter of the continental United States. The EA discussed the potential impacts that might occur during the construction and operation of the proposed air route surveillance radar (ARSR) facility at Childs Mountain. The FAA is proposing to construct an ARSR facility on the summit of the mountain.

As a cooperating agency, the USFWS determined compatibility and negotiated stipulations that ensure compatibility, and also has provided a context within which its 20-year reclamation goal can be achieved. The publication of the decision document provided the opportunity for the USFWS, the FAA, and the Air Force (Joint Radar Program Group) to execute a Memorandum of Understanding (MOU) allowing the construction activity to occur, and defining the role of each of the agencies involved in site management of the Childs Mountain summit area. With the execution of the MOU, the USFWS re-issued site permits to the FAA and the Air Force.

The planned upgrade of the FAA radar is part of a national radar replacement program. The Childs Mountain site is one of several facilities around the perimeter of the continental United States that would have a multi-agency purpose. Based upon evidence provided to the USFWS, the FAA and other sponsoring agencies (including the Air Force, U.S. Customs Service, and Border Patrol) have demonstrated that the Childs Mountain summit provides the level of radar coverage to meet each of the agencies' defined missions relative to the radar site. The USFWS's proposed alternative in its April 1997 Draft Comprehensive Management Plan EA for the Cabeza Prieta NWR provides additional discussion as to why the FAA should be allowed to upgrade its facility and specifies stipulations that will ensure compatibility with refuge purposes as well as provide for additional summit reclamation, wildlife-friendly reorientation of current physical barriers, and funds for a wilderness overlook interpretive site.

6.1.9 Hickiwan Casino, Convenience Store, and Recreation Vehicle Park

The Tohono O'odham Nation and the Tohono O'odham Gaming Authority have recently completed the construction of a casino/convenience store facility located near Why, Arizona. The Nation and the Hickiwan District have also constructed a recreational vehicle park adjacent to the casino. The casino and convenience store complex is located on approximately five acres of Indian trust lands about one mile east of Why, Arizona, along State Route 86. The facility consists of about 6,000 square feet of interior space and about 80 car parking spaces and 5 bus parking spaces. The casino has not yet opened for business,

but the convenience store and recreational vehicle (RV) park are now open.

The RV park is located within 215 acres of tribal trust lands adjacent to the casino site, and consists of 92 spaces on about eight acres of land. The RV spaces have concrete pads and are equipped with electricity, sewer, and water hook-ups. The park has its own water well and water treatment processing equipment. The remainder of the parcel is reserved for open space and recreation, but could be made available for future expansion of the RV park.

6.1.10 Residential Development in Vicinity of BMGR Boundary

Residential development is occurring in the vicinity of the BMGR boundary primarily near the communities of Wellton and Yuma. Within or adjacent to the City of Yuma, two mixed use (residential and commercial) projects have been identified approximately two miles north of the BMGR boundary. The first proposal consists of about 380 acres of recently annexed land and has been approved by the planning commission. The second proposal is a master planned community consisting of about 1,537 acres, and has yet to be approved by the planning commission. Also within Yuma, the subdivision known as Tierra Mesa has proposed to expand by about 250 residences.

South of Yuma, residential growth is occurring along the western edge of the range, primarily in the form of RV parks and low-density (2 to 5 acre) parcels. In the Foothills area east of Yuma, approximately 160 acres of land located about one mile north of the BMGR boundary have recently been rezoned for a manufactured housing development. East of the Gila Mountains,

land south of I-8 is being subdivided into 5-acre parcels.

6.1.11 U.S. Border Patrol Activities

The southern boundary of the BMGR shares approximately 94 miles of the international border between the United States and Mexico. The U.S. Border Patrol, a unit of the Immigration and Naturalization Service, is responsible for preventing undocumented aliens from illegally entering the United States and apprehending aliens who have already entered the United States illegally. On the BMGR, the Border Patrol conducts near-daily reconnaissance by air or ground surveillance. There are two Border Patrol jurisdictional sectors on the BMGR divided by the Pima/Yuma County border. 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.

Air surveillance is conducted using low flying fixed-wing aircraft and helicopters. Ground surveillance, for the most part, is conducted on Border Patrol drag roads. At times, Border Patrol ground surveillance requires off-road vehicle use.

6.1.12 Cabeza Prieta National Wildlife Refuge

The Cabeza Prieta NWR includes 860,110 acres, of which 822,000 are included in the BMGR. The refuge was established in 1939, primarily for the protection of the desert bighorn sheep, as well as for the conservation and development of native wildlife and resources. The Cabeza Prieta NWR is administered by the USFWS. Approximately 95 percent of the refuge was

designated as federal wilderness with the passage of the 1990 Arizona Desert Wilderness Act (P.L. 101-628). All of the designated wilderness is located within the BMGR withdrawal area.

The USFWS released a draft comprehensive management plan EA for the refuge in April of 1997 and is anticipating a final EA and decision document by September 1998. The proposed alternative within the plan details new refuge goals for wildlife and habitat management and the management of compatible wildlife-dependent recreation. The draft establishes a preferred natural resource and wilderness management framework that addresses a variety of issues facing the USFWS including military activities on and above the refuge.

The Cabeza Prieta NWR Draft Comprehensive Management Plan proposes a management framework and advocates standards and thresholds for low-level overflights and other military activities consistent with the 1994 MOU between the Air Force, Marine Corps and the USFWS. The management framework proposed in the draft plan neither advocates the possible elimination of nor the possible inclusion of the 822,000 refuge acres currently withdrawn under P.L. 99-606 from the range renewal proposal.

6.1.13 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. With regard to the BMGR, key activities of the Department include issuing hunting permits and enforcing permit requirements, working actively in various Sonoran pronghorn recovery programs, constructing and maintaining wildlife water catchments, and other wildlife and participating in habitat

management programs. AGFD periodically flies over portions of the BMGR to survey bighorn sheep and Sonoran pronghorn populations.

6.1.14 Lechiguilla-Mohawk Habitat Management Plan

The BLM, AGFD, MCAS Yuma, and Luke AFB Lechiguilla-Mohawk Habitat Management Plan covers wildlife improvement projects on approximately 930,000 acres of public land, including the western section of the BMGR. The plan objectives include maintenance and enhancement of habitat for Sonoran pronghorn, desert tortoise, 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 and four existing wildlife water sources in these mountains to be maintained and improved. Following revision of the Sonoran pronghorn recovery plan, new permanent water sources for pronghorn may be constructed in the Mohawk Valley. An inventory of rare plants will take place and information will be sought concerning the extent and the effect of the invading Sahara mustard plant. It is expected that the plan objectives will be achieved within 20 years.

6.1.15 Flat-tailed Horned Lizard Rangelwide Management Summary

The Flat-tailed Horned Lizard Working Group of an interagency coordinating committee of federal, state, and local representatives produced guidance for the conservation and management of sufficient

habitat to maintain viable populations of flat-tailed horned lizards. The Rangelwide Management Strategy calls for the establishment of five flat-tailed horned lizard management areas—four in California and one in Arizona. The proposed management area in Arizona includes part of the western section of the BMGR and lands west of the BMGR.

6.1.16 Lower Gila South Resource Management Plan Goldwater Amendment

The BLM Lower Gila South RMP Goldwater Amendment was prepared in response to P.L. 99-606, which charged BLM with land management responsibility for the eastern and western sections of the BMGR. The Goldwater Amendment is the BLM's land use management plan for the BMGR. The plan addresses management of non-military land use and natural and cultural resources. The plan designates ACECs, SRMAs, and HMAs and establishes methods for managing the non-military road network and vehicle use, outdoor recreation use, and wildfire management.

6.1.17 Sonoran Pronghorn Recovery Plan

The primary objective of the USFWS Sonoran Pronghorn Recovery Plan is downlisting of the endangered Sonoran pronghorn. The plan calls for the following six actions: (1) establish a protocol for repeatable and comparable survey techniques and continue monitoring populations; (2) investigate the use of satellite telemetry to determine unknown factors of life history; (3) 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; (4) establish and monitor a new separate herd to guard against catastrophes decimating the core population; (5) examine additional specimen evidence available presently to assist in verification of taxonomic status; and (6) investigate relevant physiological characteristics as possible.

6.1.18 Yuma Training Range Complex EIS

This project proposes to improve training procedures, develop training facilities, and reconfigure airspace in the Yuma Training Range Complex. This military aviation training facility includes airspace as well as lands within the western half of the BMGR (including the airspace overlying the Cabeza Prieta NWR) and the Chocolate Mountain Aerial Bombing and Gunnery Range in California. Generally, the proposed actions include reconfiguration of training airspace; revisions to range operating procedures; development of new or improved training facilities; designation of new ground support areas; and realignment of incompatible, concurrent training activities. The EIS prepared for the proposed actions found that most of the proposed actions would not cause a notable environmental change from the existing condition. Those impacts that were notable were associated with a set of alternatives that address changes to the low-level flight corridors over the Cabeza Prieta NWR. Implementation of the alternatives that address the low-level flight corridors would introduce a new source of noise into the Growler Valley portion of the refuge and increase the frequency of noise in the refuge.

6.1.19 Future Aircraft and Weapons Systems

Because of the expansive land and air resources of the BMGR, the range is a

candidate to support training with future aircraft and weapons systems. Four advanced aircraft types that are under various stages of development are slated to replace aircraft in the current inventory. These aircraft include the F-22A "Raptor," F-18 E/F "Super Hornet," V-22 "Osprey," and Joint Strike Fighter. Of these, all except the F-22 "Raptor" are likely to be used on the range in lieu of existing aircraft such as the Navy F-14s and Navy/Marine Corps F/A-18s, and Air Force F-16s and A-10s. Future aircraft would be employed in much the same way as current aircraft.

There is an emerging potential for training on the BMGR with stand-off weapons for air-to-ground attack such as the Joint Direct Attack Munitions (JDAM) and Maverick missile. Training with long-range weapons at their full stand-off range could require the closure of the BMGR to public entry during training activities. Impact points would likely be existing HE hills or inert targets within North or South TAC ranges. At this time, however, it has not been determined that stand-off weapons will be used on the BMGR or, if they are used, when, how, and how frequently such training would occur.

6.1.20 Kofa NWR and Wilderness and New Water Mountains Wilderness Interagency Management Plan

The Interagency Management Plan for the Kofa NWR and Wilderness is combined with the management plan for the New Water Mountains Wilderness, which is located just south of the refuge and shares common Wilderness with the refuge. The management plan is designed to protect natural resources and values of the planning area for the long term and to provide for public appreciation of the refuge as appropriate and compatible with the purposes for which it was established. In addition, the plan addresses national goals established for the National Wildlife Refuge System and the

National Wilderness Preservation System. There are four objectives in the plan: (1) preservation of Wilderness values; (2) wildlife and habitat management; (3) recreation, legal access, and public information; and (4) minerals management.

6.1.21 Organ Pipe Cactus National Monument

Organ Pipe Cactus National Monument, managed by the National Park Service, was established by Presidential Proclamation in 1937 to preserve approximately 330,689 acres of Sonoran Desert for the public interest. The monument is adjacent to the southeast boundary of the BMGR and Cabeza Prieta NWR. Approximately 95 percent of the monument has been established as designated wilderness or authorized as potential wilderness.

Organ Pipe Cactus National Monument contains a visitor center, scenic paved and unpaved roads, hiking trails, campgrounds, and picnic areas. The primary management responsibility for the monument's wilderness is to ensure resource protection while providing for appropriate public use (U.S. DOI 1996).

In 1997 the National Park Service completed a general management plan and developmental concept plans for the monument to carry out the concepts of the Man in the Biosphere program by adopting a regional perspective to improve visitor services and conserve resources. The plans also address improving management capabilities to enhance visitor opportunities and protect resource and Wilderness values within the monument.

6.1.22 El Pinacate Y el Gran Desierto de Altar

El Pinacate Y el Gran Desierto de Altar (The Pinacate and Great Desert) is a 745,940-acre core protection area and protective buffer area established to preserve this unique area in Mexico. Volcanic activity in this area has left giant moon-like landscape craters, black soil, cinder cones and extinct volcanoes, plus a large volcanic mountain. The flora and fauna of the area are characteristic of the Sonoran Desert. It also contains one of the richest, relatively undisturbed archaeological records in the Southwest. Recreational opportunities include four-wheel driving, hiking, camping, sightseeing, photography, and observing wildlife.

6.1.23 Man and the Biosphere Program

The United Nations Educational, Scientific and Cultural Organization (UNESCO) has developed a Man and the Biosphere Program, which designates specific areas as biosphere reserves. 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. In the project vicinity there are two designated biosphere reserves: the Organ Pipe Cactus National Monument, designated in 1976, and El Pinacate Y el Gran Desierto de Altar, designated in 1992. The International Sonoran Desert Alliance is currently discussing the issue of expanding the biosphere reserve region to include lands surrounding Organ Pipe Cactus National Monument and El Pinacate Y el Gran Desierto de Altar. The BMGR has also been considered for this status.

6.1.24 Military Training Route Realignment

The Air Force has prepared an EA that proposes to realign and/or widen portions of six of the seven MTRs (VR-223, VR-239, VR-244, VR-259, VR-260, and VR-263) that generally overlie the Tohono O'odham Nation. The purpose of this proposed action is to divert MTRs from villages or other areas of activity on the Tohono O'odham Nation where aircrew training on MTRs may produce adverse noise or visual impacts. The proposed realignments have no military operational benefits. Three of the MTRs are managed by Luke AFB, two are managed by Davis-Monthan AFB, and one is managed by the Arizona ANG. All six of the MTRs terminate in the airspace associated with the BMGR.

6.1.25 BMGR Threat Simulators

The Air Force is studying the requirements for placing threat simulator units within the BMGR tactical ranges. These ground-based units use radar to simulate the tracking of aircraft. The purpose of these units is to emit a radar signal so that aircraft pilots can recognize that they are being tracked and can train in a manner similar to the actual combat environment in terms of evasion, maneuvers, and activation of on-board countermeasures. Up to five of these mobile units would be located at strategically located positions within the TAC ranges. Each unit is approximately 4 feet by 8 feet in size and would be activated remotely, probably from personnel at Gila Bend AFAF.

Within the Marine Corps TACTS Range, ongoing improvement efforts have included the construction of similar threat emitter equipment sites. Twelve threat emitter compounds were approved following a 1996 EA and five more are proposed in the YTRC EIS. These fenced compounds are up to 50 feet by 50 feet and contain the threat emitter equipment secured to an approximately 10-foot by 10-foot concrete tie-down pad and a generator and aboveground fuel tank on a smaller concrete pad.

6.2 CUMULATIVE EFFECTS WITH THE PROPOSED ACTION AND *ALTERNATIVE ACTION*

Because the proposed action and alternative action both would result in renewal of the BMGR land withdrawal, the cumulative effects on the resources are indistinguishable.

6.2.1 Airspace and Range Operations

A number of actions in addition to the proposed BMGR renewal are underway, proposed, or foreseen that could affect BMGR airspace. These actions include (1) ongoing construction of threat emitters as components of the Marine Corps TACTS Range; (2) actions for the BMGR proposed in the Yuma Training Range Complex EIS; (3) the proposed realignment of six MTRs; (4) the potential installation of threat emitters within the Air Force tactical ranges; and (5) future

use of new aircraft and weapons systems on the range. Assuming that the BMGR is renewed and military control and use of the overlying restricted airspace continues, these five actions would each affect how the range airspace is used, but would not be likely to affect its basic structure. No important cumulative airspace effects would likely emerge because each of these five actions is, or would be planned to be, compatible with the range airspace and its operations. No cumulative effects on airspace or aviation outside of the BMGR would result from these five actions.

6.2.2 Non-military Land and Airspace Use

The restricted airspace associated with the BMGR and, to some degree, MOAs and ATCAAs restrict incompatible civil airspace uses to segregate different airspace uses for the safety of all. The proposed ARSR facility on Childs Mountain would provide radar surveillance of civil airspace traffic north and east of the BMGR. Because there is no direct relationship between BMGR associated airspace and the proposed ARSR facility, there would be no cumulative effects to non-military airspace resources.

Land use patterns in the vicinity of the western portion of the BMGR could substantially change if the proposed Yuma Area Service Highway from the Mexico border to Interstate 8 is constructed. Although much of the region affected by this highway project is currently sparsely populated, the highway could promote industrial, commercial, and residential development in the area.

The various proposed land developments (including the San Luis Port-of-Entry, the industrial park in Sonora, and residential development) eliminate the potential for other land uses for the life of those developments.

Similarly, the proposed BMGR withdrawal and other designated land use areas within the region (including Organ Pipe Cactus National Monument, the Cabeza Prieta NWR and Wilderness, and El Pinacate Y el Gran Desierto de Altar) preclude certain types of land uses such as agriculture and mining. Most of these designated uses have been in place for decades and are in a harsh desert environment where many alternative uses would be incompatible or economically unfeasible.

While proposed non-military land development may change land use patterns and the BMGR land withdrawal would continue to preclude most development within the range, these conditions are generally consistent with land use planning in the region.

6.2.3 Public Utilities and Ground Transportation

Cumulative effects to public utilities and transportation are not expected to be substantial. No major changes in the current utility and transportation structure are expected because future actions would be consistent with current activities. However, the development of the PDAI Mine and NAFTA-related developments would be the primary causes of increased electrical needs in

the region. The primary actions potentially resulting in cumulative effects on transportation facilities in the BMGR region are the new port-of-entry east of San Luis, the development of the Yuma Area Service Highway, and increasing population and related residential development, especially in the Yuma area.

6.2.4 Noise

Cumulative noise exposure from military operations, in the BMGR region, with the exception of areas around MCAS Yuma AUX-2 and Gila Bend AFAF, averages less than 65 dB. Noise exposure levels on this order are within those normally acceptable to all types of land use provided that noise level reduction is incorporated into structures.

Because aircraft historically average less than one supersonic event per day, possibly consisting of multiple supersonic booms, which may propagate to the ground during normal air-to-air engagements over R-2301E/W or in the Sells MOA, the L_{cdn} levels under these airspace units would be expected to be less than 45 dB. As such, the impact at ground level both on-range, as well as outside of the range boundaries, would be negligible and less than 1 percent of the affected population would be expected to be highly annoyed. Thus, there would not be expected to be any significant cumulative impacts to the environment.

In addition to noise generated from military operations on the BMGR, there are currently other sources of noise in the BMGR vicinity such as highway traffic and aircraft operations by other agencies such as the U.S. Border Patrol or AGFD. Noise generated from these sources, while present, are at much lower levels than the noise associated with military aircraft operations and explosive ordnance detonations. Other aircraft that operate on the BMGR are relatively quiet in comparison to most DoD aircraft and would not be expected to cause cumulative effects to the noise exposure levels in particular, or the noise environment in general. Proposed projects that have potential to result in cumulative impact to the noise environment include operations at the PDAI Mine and traffic associated with the Yuma Area Service Highway.

The four new aircraft types that are currently under development and could potentially be used on the BMGR in the future include the F-22A "Raptor," F-18E/F "Super Hornet," V-22 "Osprey," and Joint Strike Fighter. These aircraft are expected to eventually replace those in the current inventory. The noise signature of these future aircraft may differ somewhat from that of existing aircraft, but based on the types of engines and airframes being developed, tested, or programmed for these aircraft they are not expected to generate noise effects that differ notably from those caused by existing BMGR training operations.

Noise generated by the F-22, for example, has been measured in ground run-up tests. Because of its aerodynamic design, noise generated by airflow over the F-22 airframe is expected to be no more than that generated by the F-16. However, it is estimated that the F-22, when operating in the airspace, will be approximately 11 dB (A-weighted) louder than the F-16 due to engine noise.

The F-22 has two performance characteristics that could, in principle, affect its average noise. One is that it has higher performance than the F-16. It is less likely to employ its afterburner, so it can be quieter. The second is that it is capable of a very low speed, high angle of attack flightXvirtually "standing on its tail."

This flight mode would result in higher local noise levels. This capability is not, however, expected to be used routinely or for extended periods. When used, it would be during air combat maneuvering, which takes place at high altitudes. Low speed, high angle of attack flight will therefore not occur often enough or low enough to affect cumulative noise at the ground level.

Three factors prevent a more specific estimate of the incremental or interactive impact from noise that may occur with the replacement of the current aircraft inventory with any of the four aircraft types listed above. These are: (1) these aircraft are still being developed, (2) limited information is available on the noise that could be generated as a result of using these aircraft on the BMGR, and (3) operational employment scenarios are not yet developed or are incomplete. An assessment of environmental impacts (including noise) would be required if and when new aircraft are proposed for use on the BMGR as a component of the home based aircraft compliments at installations that make regular use of the range.

6.2.5 Public Health and Safety

Although public health and safety is an issue with some past, present, and future actions, there are no cumulative effects to public health and safety since known risks are identified and managed. Operations associated with the proposed reopening of the PDAI Mine, such as the use of heavy vehicles and machinery, and the transportation, handling, and use of hazardous materials would increase risks to public health and safety. However, these risks would be minimized through compliance with all applicable EPA and Occupation Safety and Health Organization requirements for safety. The reopening of the mine would also increase traffic in the BMGR vicinity, as would the construction of the Yuma Area Service Highway. Increased traffic could lead to increased vehicle collisions. Under NEPA, both the mine and the highway projects would undergo evaluations regarding effects to traffic and take steps to minimize risks.

The risk of military personnel and the public encountering unexploded ordnance on the BMGR would continue to exist. The restrictions to public access from the highest risk area, the on-going EOD clearance programs, and the safety briefings required for a range permit would continue to minimize the public health and safety risks.

Aircraft and weapons systems currently in development that may potentially be used on the BMGR would be assessed for risks to public health and safety if and when they are proposed for introduction to the range.

6.2.6 Cultural Resources

The BMGR is estimated to contain approximately 20,000 cultural properties, the majority of which are archaeological sites valued for their information potential. Military use of the BMGR has the potential to affect at least several hundred of these sites (about 3 percent of the total), although mitigative data recovery is expected to reduce this impact through the collection and interpretation of archaeological materials that will enhance understanding of the past. Other non-military land uses that would continue within the renewed land withdrawal (such as recreation)

could also disturb cultural resources. Other actions currently in-progress or proposed in the vicinity of the BMGR that might effect additional archaeological resources include: the Gila Bend to Ajo 230kV transmission line, which will slightly impact two archaeological sites; widening of State Route 85, which could affect as many as about 20 to 30 archaeological sites; the Yuma Area Service Highway, where a few sites are reported; and the development of the Hickee Casino near Why and anticipated residential development near Wellton and Yuma.

With the exception of residential development, these actions will be accomplished in compliance with Section 106 of the NHPA; thus archaeological sites will be treated appropriately as will those subject to effect on the BMGR including those that may be subject to effect from the use of future weapons systems. Residential development on private lands where archaeological sites are unprotected poses the greatest threat, but quantification is difficult without details regarding where development will take place and how much land will be affected. Activities of the Arizona National Guard, U.S. Drug Enforcement Agency, U.S. Border Patrol, U.S. Customs, International Boundary and Water Commission, AGFD, and Arizona Department of Transportation also have the potential to affect cultural resources; it is for this reason that these agencies are being included in consultation for the ICRMP.

Restrictions on access (including restrictions on access in motor vehicles) within the BMGR (including the Cabeza Prieta NWR) and in Organ Pipe Cactus National Monument may be a concern to Native American or other traditional communities if TCPs or sacred sites that they wish to visit are present throughout these vast areas. The general public also may be interested in visiting archaeological sites and other cultural properties such as historic ranches or mines (and in having those properties publicly interpreted). Restricted access throughout much of southwestern Arizona precludes public visitation that might otherwise occur.

6.2.7 Socioeconomic Resources

Much of the area in the BMGR vicinity is undeveloped. Land uses such as agriculture, livestock grazing, recreation, mining, residential and commercial developments, and wildlife and wilderness protection all have socioeconomic impacts associated with them. These impacts include direct and indirect employment, earnings, attraction of tourism, and economic growth. The socioeconomic impacts of the BMGR, which are most pronounced at the installations that use the BMGR for training, for the most part do not accumulate with the impacts of existing and proposed land uses in the area. This lack of cumulative effect for socioeconomics is due, primarily, to the geographical extent of the BMGR socioeconomic effects.

6.2.8 Visual Resources

Because visual impacts are, in part, measured by visibility, the greatest potential for synergistic visual impacts is along the northwestern perimeter of the BMGR. The proposed Yuma Area Service Highway would modify the natural landscape and add moderate to high sensitive views into a portion of the range that is currently restricted from public entry with the introduction of a

new highway, fence, and signs. In addition, development along the northwestern edge of the range in the Yuma and Wellton areas would modify what is primarily undeveloped land due to the construction of residences and associated infrastructure. Impacts to views from existing and future residences would occur in this area as a result of these predicted changes. The cumulative effect to visual resources could be increased visual sensitivity and less landscape diversity (and, thus, less scenic quality).

Other actions having lesser incremental impacts on visual resources include the construction of the Gila Bend to Ajo 230 kV transmission line and improvements at Childs Mountain. The transmission line would add to the existing modifications and impact high sensitivity views along State Route 85 and at rest stops.

The proposed construction of an ARSR facility at Childs Mountain would contribute to the most highly modified landscape within the Cabeza Prieta NWR portion of the BMGR. Also on Childs Mountain, a proposed USFWS watchable wildlife overlook would open this area to the public for interpretive purposes. The incremental impact of these actions could lead to higher visual sensitivity.

Military, agriculture, livestock grazing, recreation, mining, residential and commercial development, and Border Patrol surveillance activities within and adjacent to the BMGR have all contributed to a deterioration of the natural landscape and scenic quality of the BMGR region. Visual resources in developed lands surrounding the BMGR are markedly degraded in comparison with the BMGR.

Overall, the cumulative impact to visual resource is minimal since most actions do not involve great changes to the landscape. On BLM managed lands, visual resource management classes would likely be unaffected.

6.2.9 Recreation

The restrictions to access in some portions of the BMGR for public health and safety reasons do not have cumulative effects on recreation. Many areas of the BMGR remain open to visitors with valid range permits. Other recreational sites in the immediate vicinity, such as Organ Pipe Cactus National Monument and BLM wilderness areas, offer recreation opportunities similar to those currently or potentially available on the BMGR.

6.2.10 Hazardous Materials and Waste

Proposed construction projects in the vicinity would result in a slight increase in the use of hazardous materials and possible release of wastes, particularly petroleum products used to fuel construction equipment. The proposal to resume mining operations at the PDAI Mine would also contribute to increase in transportation, use, and storage of hazardous materials and the generation and handling of hazardous waste at the mine. Because these projects must comply with all applicable regulations for the proper transport, storage, handling, and disposal of

hazardous waste and materials and practice pollution prevention, risks are expected to be minimal.

6.2.11 Earth Resources

For earth resources, the most notable incremental impact occurs as a result of the military uses in combination with the non-military surface uses of the range. Ground disturbance from military activities accumulates with other non-military surface disturbing activities, particularly with on- and off-road vehicle use. There are also some possible cumulative effects to mining and energy resource development because the land withdrawal precludes these activities and so do wilderness areas and national wildlife refuges in the area.

Many of the almost 600 miles of established military roads on the range are also used by non-military users for activities such as recreation, international border surveillance, and natural and cultural resource management. There are also hundreds of miles of established roads on the BMGR that are not used by the military, mostly unimproved recreation roads and Border Patrol drag roads. Roads within the Cabeza Prieta NWR are primarily limited to two main travel routes and a few administrative roads that are closed to public travel. The Wilderness designation assigned to most of the refuge protects the refuge environment from the development of additional roads. The Lower Gila South RMP Goldwater Amendment transportation plan component (currently underway) will determine, along with other detailed information, the number of miles of non-military roads in the eastern and western sections of the BMGR.

Off-road vehicle use on the range primarily occurs (1) in Marine Corps ground support areas, (2) in annual and five-year EOD sweep areas, and (3) from U.S. Border Patrol surveillance activities that require off-road vehicle use.

Both on- and off-road vehicle use may cause wind and water erosion from disturbance of the soils, displacement of vegetation, disruption of soil profiles, disruption of the desert varnish, and exposure of loose soils to wind. Compaction of the soils from vehicles and heavy equipment may cause loss of vegetation and increased soil erosion. However, the resulting cumulative effect from the incremental impact caused by military and non-military activities is minimal in context of the lack of disturbance to most BMGR lands. Implementation of the BLM transportation plan could lead to a reduction in this cumulative effect if controls are placed on non-military vehicle use. Limiting the surface use footprint of military operations to the minimum possible would also lead to a reduction in effects.

A second possible additive impact is that the renewal of the range would continue to make mineral and energy resources unavailable for development in an area that has other prohibitions on mining. As an effect of the renewal, mining and mineral leasing and energy resource development would continue to be precluded for at least the duration of the renewed land withdrawal. This is coupled with the restrictive land use controls for the Cabeza Prieta NWR, ACECs, and other special management areas, and further combined with the prohibitions of mining elsewhere in the vicinity of the BMGR (Wilderness areas and National Wildlife Refuges). The cumulative effect of these impacts is undetermined because the mineral and energy resources may exist on the range but, although these potential resources will not be lost

with continued renewal of the range, there is a potential economic loss because of the continued restrictions. The feasibility and economic viability of developing energy and mineral resources is unknown.

6.2.12 Water Resources

Like earth resources, the notable cumulative effect of the renewal of the range on water resources is the combined impact of military and non-military surface uses of the BMGR. The military and non-military sources of soil disturbance on the range have elevated naturally occurring erosion patterns. Thus, increased sedimentation is carried in ephemeral surface waterways and is transported to receiving waterways. However, in most areas the increased sedimentation does not reach natural off-range receiving waters such as the Gila and Colorado rivers. The Union Pacific Railroad and Interstate 8 to the north of the range have effectively created surface water detention basins where storm water runoff pools and sedimentation settles prior to the draining of surface water to the north through culverts. This decreases the amount of sediment that is transported off of the range. Construction of the proposed Yuma Area Service Highway on the western edge of the range could have similar effects; however, impacts are expected to be minimal since, as a federal project, the highway would be constructed according to best management practices. Thus, the overall cumulative impact of the renewal of the BMGR on water resources is minimal.

6.2.13 Air Quality

Proposed land developments would be expected to contribute to deterioration in air quality, at least in the short term when ground disturbing activities are likely to increase PM₁₀. Proposals that might increase the quantity of vehicle miles driven in the region (such as the new Port-of-Entry, Yuma Area Service Highway, Hickiwan Casino, and the industrial park in Sonora) would result in increases in automobile emissions in the area. The proposal to resume mining operations at the PDAI Mine would also contribute to the emission of air pollutants. While such increases in air emissions can be estimated if the other proposals are implemented, it is beyond the scope of this LEIS to determine the quantity of increased emissions that may occur. Most of the proposed actions would be subject to federal, state, or local laws and regulations that would require mitigation measures to limit the amount of air pollutants emitted.

6.2.14 Biological Resources

A significant effect of the military withdrawal of the BMGR has been the preservation of biological resources for a large portion of the Sonoran Desert. The cumulative effect of all BMGR military ground impacting activities on vegetation and wildlife habitat has been, and would continue to be, minimal. Currently less than two percent of the range has had a high to complete level of ground disturbance, and proposed operations would continue to be primarily limited to these previously impacted areas. The dispersed nature of military activities do not create barriers to wildlife movement or contribute to habitat fragmentation. The exclusion of

other land uses (e.g., mining, livestock grazing) from the range for safety concerns has further protected sensitive natural resources.

With the proposed BMGR renewal action, wildlife would continue to be exposed to aircraft and aircraft noise from ongoing military operations. While only a few species have been studied to evaluate how aircraft noise affects them, there appears to be consensus that noise has short-term effects on wildlife. While the documented short-term effects may be unpleasant for some species, it does not appear that there are any adverse long-term effects. The fact that sensitive species, such as the Sonoran pronghorn and desert bighorn sheep, have coexisted with military activities on the BMGR for more than 57 years tends to support this conclusion.

Ground impacting military operations (e.g., ordnance delivery) authorized for the BMGR do not extend off of the range. Air activities associated with training on the BMGR do extend off the range and add to the noise wildlife in the region are exposed to. However, as previously discussed, long-term effects on wildlife from such exposure are unlikely.

Prior to establishment of the BMGR, the area supported non-military activities such as mining and livestock grazing. Abandoned adits and shafts on the BMGR provide shelter for wildlife including important roost sites for bats. Under the proposed renewal action, these abandoned mine sites would be protected from human disturbance and mining activities. Elimination of grazing on the BMGR may have resulted in an increased density of plants in areas where grazing once occurred.

Present non-military activities on the BMGR include ground and aerial surveillance by the U.S. Border Patrol, Sonoran pronghorn radio-collaring and surveys by AGFD, wildlife research, and limited recreational activities including camping, hiking, hunting, and off-road vehicle use. Low-level flights at altitudes less than 200 feet above ground level (AGL) are made on an almost daily basis by the U.S. Border Patrol and on an irregular basis by AGFD. AGFD also conducts weekly monitoring flights at 1,000 feet AGL. U.S. Border Patrol and AGFD activities contribute to wildlife exposure to aircraft and aircraft noise on the BMGR. Radio-collaring of Sonoran pronghorn by AGFD has resulted in mortality of captured pronghorn. Recreational activities on the BMGR presents a source of disturbance to wildlife, although access to the BMGR is limited, and sensitive resources such as bat roost sites, aeolian dunes, and water sources are protected by restrictions on human activity. Recreational vehicle use is restricted to designated routes within ACECs and established roads on the remaining portion of the BMGR; however, unauthorized use of vehicles off of roads does occur and results in damage to vegetation. Also, some roads on the BMGR serve no military purpose, but are used for recreational access. These roads contribute to the loss of habitat on the range.

Potential non-military projects on the BMGR include construction of the Gila Bend to Ajo 230kV transmission line, and an FAA air route surveillance radar facility on Childs Mountain. These could be implemented in the reasonably foreseeable future. Impacts to biological resources resulting from construction of the transmission line would include disturbance to wildlife during construction and a minor loss of vegetation and wildlife habitat. The transmission line would roughly parallel an existing transmission line and State Route 85. Facilities presently exist on Childs Mountain adjacent to the proposed FAA air route surveillance radar facility. The proposed facility would result in construction of a new pad and upgrading the existing road. Impacts to biological resources would be minimal.

Regional land uses include agriculture, grazing, recreation, mining, transportation, utility, residential and commercial development, and wildlife habitat and wilderness protection. With the exception of management for protection of wildlife habitat and wilderness, these land uses can result in habitat fragmentation, damage or loss of vegetation and wildlife habitat, wildlife injury and mortality, and disturbance to wildlife. Descriptions of other existing, planned, or proposed land use activities in the vicinity of the BMGR are identified and described in Section 6.1.

Past developments surrounding the BMGR have fragmented habitat linkages for many species, especially ungulates (hoofed mammals) such as Sonoran pronghorn, mule deer, javelina, and bighorn sheep. Of particular significance is the barrier created by Interstate 8, the Southern Pacific Railroad, and the system of canals situated north of the BMGR and extending from Yuma to Gila Bend. These developments preclude movement from the BMGR to habitat north of the range; such as the Yuma Proving Ground, Kofa NWR, and large tracts of BLM-administered lands. These barriers preclude northern range extensions by Sonoran pronghorn and effectively fragment existing mule deer, bighorn sheep, and javelina populations. The opportunity for non-avian wildlife on the BMGR to access water from the Gila River has also been lost. East of Gila Bend, Interstate 8 continues to fragment habitat; however, in the absence of a railroad, canal, and agricultural development, some movement of wildlife across this portion of the interstate highway may be possible. State Route 85 represents less of a barrier to wildlife movement than Interstate 8.

The proposed Yuma Area Service Highway would also likely present a barrier to wildlife movement. A portion of this highway would traverse the westernmost section of the BMGR. Impacts to the flat-tailed horned from this highway development is an important concern as are the impacts from residential development in the Yuma area.

There have been several positive developments relative to conservation and management of biological resources in the vicinity of the BMGR in recent years. Many of these are summarized in Section 6.1 and include development and implementation of the Flat-tailed Horned Lizard Rangewide Management Strategy (both on and off the BMGR), development of a comprehensive management plan for the Cabeza Prieta NWR, development of the Kofa NWR and Wilderness and New Water Mountains Wilderness Interagency Management Plan, designation of wilderness on the Organ Pipe

Cactus National Monument, preservation of the El Pinacate Y el Gran Desierto de Altar, the Man and the Biosphere Program, and implementation of the Sonoran Pronghorn Recovery Plan.

In sum, while there are cumulative noise effects from aircraft operations conducted by DoD, AGFD, and the U.S. Border Patrol, there is no conclusive evidence that such noise adversely affects the viability of wildlife populations. Similarly, military ground operations, recreational roads, and utility and transportation corridors through the range contribute cumulatively to habitat disturbance. Yet, the vast majority of the BMGR is in nearly pristine biological condition and the effects on wildlife resources from these disturbances are mostly negligible.

6.3 CUMULATIVE EFFECTS WITH THE NO-ACTION ALTERNATIVES

The no-action alternative would result in the end of the military use of the BMGR surface area, although it would not necessarily end the military use of the airspace above the land. Though future land use after termination of the land withdrawal cannot be predicted with any degree of accuracy, the BLM would become responsible for the management of the former military lands. The BLM would determine the future use of the lands through a public planning process and would conduct an environmental impact analysis of the land use alternatives to be considered.

If the land withdrawal were not renewed, the Secretary of the Interior, in consultation with the Secretary of the Air Force, would determine what areas of the former range could be decontaminated in a practical and economically feasible manner. The impact of any proposed reuse of the former range lands as well as the proposed actions to decontaminate lands would have to be assessed in consideration of the other regional actions that may contribute to a cumulative effect.