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U.S. Fish and Wildlife Service
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In Reply Refer To:
AESO/SE
22410-2007-F-0132
02-21-02-F-229
02-21-98-F-266

June 14, 2007

Colonel Jonathan B. Hunter
Commander, U.S. Army Garrison
2837 Boyd Avenue, Rodney Hall
Fort Huachuca, Arizona 85613-7001

Dear Col. Hunter:

Thank you for your request for formal consultation with the FWS pursuant to section 7 of the Endangered Species Act of 1973 (16 U.S.C. 1531-1544), as amended (Act). Your request was dated December 28, 2006, and received by us on December 29, 2006. We transmitted a letter requesting additional information on January 11, 2007. Your submittal of additional information was dated February 12, 2007, and was received by us on February 14, 2007. At issue are impacts that may result from the proposed ongoing and future military operations and activities at Fort Huachuca, Cochise County, Arizona. The proposed action may affect the endangered Huachuca water umbel (*Lilaeopsis schaffneriana* var. *recurva*) and the species' critical habitat, the endangered southwestern willow flycatcher (*Empidonax traillii extimus*) with critical habitat, the threatened Mexican spotted owl (*Strix occidentalis lucida*), the endangered lesser long-nosed bat (*Leptonycteris curasoae yerbabuenae*), and the endangered Sonora tiger salamander (*Ambystoma tigrinum stebbinsi*).

You also requested formal consultation on the Huachuca springsnail (*Pyrgulopsis thompsoni*), a candidate for Federal listing, and the Ramsey Canyon leopard frog (*Rana subaquavocalis*), which lacks any Federal status at this time, and you requested informal consultation on the yellow-billed cuckoo (*Coccyzus americanus*), a candidate for Federal listing. We do not consult nor confer on actions that affect species that are not proposed or listed under the Act. We will, however, provide technical assistance on these species at your request.

In your December 28, 2006, and February 14, 2007, letters, you requested our concurrence with your determination that the proposed action may affect, but is not likely to adversely affect the endangered Canelo Hills ladies' tresses (*Spiranthes delitescens*); the threatened bald eagle (*Haliaeetus leucocephalus*); the endangered jaguar (*Panthera onca*); the threatened spikedace (*Meda fulgida*) with then proposed, now final critical habitat; the endangered Gila topminnow (*Poeciliopsis occidentalis occidentalis*), and the endangered desert pupfish (*Cyprinodon macularius*) with critical habitat. We concur with your determinations for these species, and have provided our rationales in Appendix A.

Your December 28, 2006, letter also stated that you had determined your proposed action would have no effect on the threatened Cochise pincushion cactus (*Coryphantha robbinsorum*),

candidate Lemmon fleabane (Erigeron lemmonii), endangered northern aplomado falcon (*Falco femoralis septentrionalis*), endangered Ocelot [*Leopardus* (=*Felis*) *pardalis*], threatened Chiricahua leopard frog (*Rana chiricahuensis*), threatened New Mexico ridge-nosed rattlesnake (*Crotalus willardi obscurus*), endangered California brown pelican (*Pelecanus occidentalis californicus*), endangered Gila chub (*Gila intermedia*), threatened beautiful shiner (*Cyprinella formosa*), threatened Yaqui catfish (*Ictalurus pricei*), endangered Yaqui chub (*Gila purpurea*), and the endangered Yaqui topminnow (*Poeciliopsis occidentalis sonoriensis*). We recommend that you maintain a complete administrative record documenting the decision process and supporting information for these determinations.

This draft biological opinion is based on information provided in: (1) the December 2006 *Programmatic Biological Assessment for Ongoing and Future Military Operations and Activities at Fort Huachuca, Arizona* (PBA); (2) the February 2007 addendum to the PBA (Revised PBA); (3) meetings, telephone conversations, and exchanges of electronic mail between our respective staffs; and (4) other published and unpublished sources of information. Literature cited in this biological opinion is not a complete bibliography of all literature available on the species of concern or the effects of military operations on fish, wildlife, and plants, or on other subjects considered in this opinion. A complete administrative record of this consultation is on file at the Arizona Ecological Services Office (AESO).

Consultation History

- August 23, 2002: We transmitted to you our final biological opinion (File nos. 2-21-02-F-229 and 2-21-98-F-266) of the effects of activities authorized, carried out, or funded by the Department of the Army at and near Fort Huachuca (Fort), Arizona on the Huachuca water umbel and critical habitat, southwestern willow flycatcher, Mexican spotted owl with critical habitat, lesser long-nosed bat, and Sonora tiger salamander. The proposed action was found to not jeopardize these species, nor adversely modify critical habitat where designated.

- March 16, 2006: We received your March 10, 2006, letter stating that preparation of the PBA was underway.

- June 21, 2006: You transmitted to us a letter stating your intent to reinitiate formal consultation.

- January 11, 2007: We transmitted to you a letter (File nos. 22410-2007-I-0132, 2-21-02-F-229, and 2-21-98-F-266) acknowledging the receipt of your PBA and outlining the additional information we required in order to complete formal consultation on the proposed action.

- February 14, 2007: We received your February 12, 2007, response to our January 11, 2007, request for additional information. Your letter included a revised PBA and appendices. Though sufficient information was received with which to complete formal consultation, we did not respond with a letter to that effect.

- May 24, 2007: We transmitted the draft biological opinion to you.

- June 7, 2007: We received your June 5, 2007, comments on the draft biological opinion.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

The following narrative has been adapted directly from the Revised PBA to ensure an accurate description of the proposed action, including the proposed conservation measures.

The proposed action includes programmed facilities development projects on the installation, resource management, recreation, and other land uses. This section concludes with summary descriptions of operations and activities that occur in, or are programmed for, training areas across the installation. This section incorporates the conservation measures in Section 5 of the Revised PBA, which will be implemented by Fort Huachuca as part of the proposed action. These conservation measures will also be restated in the section entitled Description of the Proposed Conservation Measures, which follows.

The ongoing and future military operations and activities at Fort Huachuca that are evaluated in the Revised PBA and this biological opinion do not include the potential for a Base Realignment and Closure (BRAC) action. There is a potential for another BRAC to occur within the 2011-2014 timeframe, at which time Fort Huachuca could be significantly affected, either by realignment or closure. If Fort Huachuca is part of a BRAC action in the future, it will be covered under a separate consultation.

Baseline Operations, Activities, and Missions

The ongoing missions and activities at Fort Huachuca constitute the baseline at the installation. Additional activities and missions that have occurred since the 2002 BA are included in the operational baseline. These include increases in military intelligence training load, classrooms, single soldier housing and testing and training facilities [Environmental Assessment (EA), Dec 2001 and EA, Nov 2004], the replacement of two elementary schools on Fort Huachuca, Rehabilitation of Historic Adobe Structures at Fort Huachuca, Arizona (EA, March 2002), Implementation of an Integrated Cultural Resources Management Plan (EA, August 2002), Construction and Operation of a DOD HUMINT Training Center, Fort Huachuca (EA, November 2002), Construction and Maintenance of a Security Fence for LAAF/Sierra Vista Municipal Airport at Fort Huachuca, AZ (EA, April 2003), Future Development Master Plan for the Joint Interoperability Test Command (EA, May 2004), Wilcox Gate Area Development Plan (EA, May 2004) and USAIC Future Development Plan (EA, November 2004).

This section also includes several proposed actions for which NEPA analysis is either completed or in progress, but the decisions to implement the projects have not been made. These projects include: a proposed Air National Guard UAV squadron, a renewable energy Environmental Assessment (EA) in draft, expanded border patrol activities at Fort Huachuca to include UAV activities, expansion of Sites Papa and Uniform, range improvements to include upgrading Range 13, creating a convoy live-fire course on the east range, establishing a forward operating base at Site Maverick, developing a Military Operations Urban Terrain Facility, creating an unmanned aerial systems training battalion, establishing an EPG multipurpose building and UAV runway on the east range, and establishing a Joint Center of Excellence for MI training.

Intelligence and communications systems testing and training activities account for nearly 95 percent of training range use (USAIC&FH, 1997). Other supported activities on the installation include field training exercises, aviation activities, live-fire qualification and training, vehicle maneuver training, and administrative and support activities e.g., CPOC.

Military Operations and Activities

Fort Huachuca is currently under the management of the Installation Management Command (IMCOM). Fort Huachuca's installation management functions, including environmental management, fall under the West Regional Office, located in San Antonio, Texas. Fort Huachuca remains the Headquarters for the US Army Intelligence Center (USAIC). It is also the headquarters for the US Army Signal Command (USASC). In October 2002, the USASC transitioned to become the 9th ASC/NETCOM. The Garrison Commander and principal training staff are currently integrated into the USAIC Headquarters Command, designated USAIC&FH. Major missions assigned to the installation exist to:

- research, develop, test, and evaluate concepts, doctrine, materials, and equipment in the areas of intelligence, electronic warfare, and information systems;
- develop, conduct, and evaluate training in intelligence, electronic warfare, and information systems;
- provide trained operational forces in the areas of intelligence and communications;
- operate, manage, and defend the Army's information operations and infrastructure;
- perform aviation operations; and
- provide training opportunities for Active Duty, Reserve, and National Guard Forces.

Military Intelligence Training

Fort Huachuca currently provides Military Intelligence (MI) training to over 14,000 temporarily assigned students annually. To better enable the United States to fight the war against terrorism, an EA was prepared in December 2001 to support expanding the Army's training base to produce greater numbers of highly skilled soldiers capable of executing critical National Defense MI missions.

Intelligence and Communication Systems

The majority of operational testing and training at Fort Huachuca is related to intelligence and communications systems. Units are engaged in the development and testing of various types of electronic equipment (see Appendix B in the Revised PBA for detailed descriptions of these units). These units are also involved in training soldiers in the use of this equipment in classrooms and during field training exercises. Environmental Assessments (USAIC&FH 1992, USAIC&FH 1993) were prepared to address all of the field testing and training of electronic equipment and the field exercises conducted in connection with this testing and training.

Management, Operation, and Defense of Army Information Systems

In order to fight the war against terrorism, the NETCOM/9TH Signal Command has taken on additional responsibilities for the management, operation, and defense of all army information systems. In October 2002 it transitioned to 9th ASC/NETCOM which will involve hiring up to 130 personnel over the next several years to take on this mission. This activity is also incorporated into the operational baseline of this Revised PBA.

Intelligence and Electronic Warfare Equipment Training and Testing

A major mission at Fort Huachuca is the testing of intelligence and electronic warfare equipment and training of soldiers on intelligence tactics and procedures requiring realistic placement of intelligence systems globally. Equipment is stationed at various Army Security Agency (ASA) sites across the installation and off-post to test the capability of electronic systems to operate under a variety of geographic and atmospheric conditions (USAIC&FH 1992, USAIC&FH 1993). These sites constitute a network of approximately 2,400 on-post and 675 off-post markers (Figures 1 and 2). Training and testing is conducted by dispatching intelligence and electronic warfare equipment to a selection of ASA sites that meet the requirements for training to be conducted. On-post sites are located across the installation along existing roads and trails and previously disturbed areas. Off-post sites are usually located within the road right-of-way shoulders along several highways in Cochise and Santa Cruz counties. The remaining off-post sites are located in previously disturbed areas.

At the time of training, vehicles and personnel can be deployed to any combination of ASA sites but most remain on Fort Huachuca. Training sites generally consist of 1-2 vehicles with 4-6 support personnel and up to approximately 20 students. On rare occasions, training activities can be as large as 20 vehicles, 50 support personnel, and 60-70 students (USAIC&FH 1992, USAIC&FH 1993). Types of equipment include electronic, computer, or radar imaging systems. The vehicular components of the intelligence training systems can consist of military 5- ton trucks, heavy duty 4-wheel drive vehicles, and on very infrequent occasions, tracked vehicles. These vehicles are either equipped with an electronic equipment shelter or are used to transport soldier-transported systems and operators. These vehicles are either driven to previously established parking areas at the site or other designated sites are authorized. Vehicles must either remain on established roads or trails or can park adjacent to the road or trail in a previously disturbed, designated area at each ASA site. Tracked vehicle movement is not authorized outside of the installation and is confined to existing roads and trails in Training Areas Bravo, Charlie, Delta, and Foxtrot on the East Range (refer to Table 4 in Section 2.9 of the Revised PBA for detailed information on individual training area activities). Tracked vehicles are sometimes used outside the installation but on these occasions they are transported to the training or test site on trailers and they are off-loaded but remain stationary.

Several types of transmitting antennae are used, from small vehicle or system mounted whip antennae, to ground mounted antennae that can be raised to a height of 20-25 meters. Testing activities in some cases last for periods of up to 90 days. At each site, antennae(s) may be erected consisting of driving metal or wooden stakes into the ground 12-18 inches for the attachment of guy wires. Exercises generally last for no more than 10-11 days with 18 daily hours of operation (USAIC&FH 1992, USAIC&FH 1993). This training can require 30-50 students to walk cross-country to other predetermined locations/ASA sites. Training sites located in or near protected

agave management areas found in Training Areas Lima, Mike, Hotel, India, Tango, Victor, and X-Ray, and adhere to special use regulations. These regulations stipulate that:

- no firing of blanks or pyrotechnics will occur with 0.25 mile of protected agave management areas;
- training and test sites will not be used by personnel on foot unless the activity has a Range Control approved plan for fire suppression and minimal fire fighting equipment; and
- night operations are prohibited in protected agave management areas while LLNB is present on Fort Huachuca (minimum July 1 – October 31).

Military trainers and civilian testers who fail to comply with these measures of protection may, at the discretion of the Range Control Officer, lose their privilege to train or test in these areas.

Figure 1: Fort Huachuca Training Areas and On-Post ASA Sites

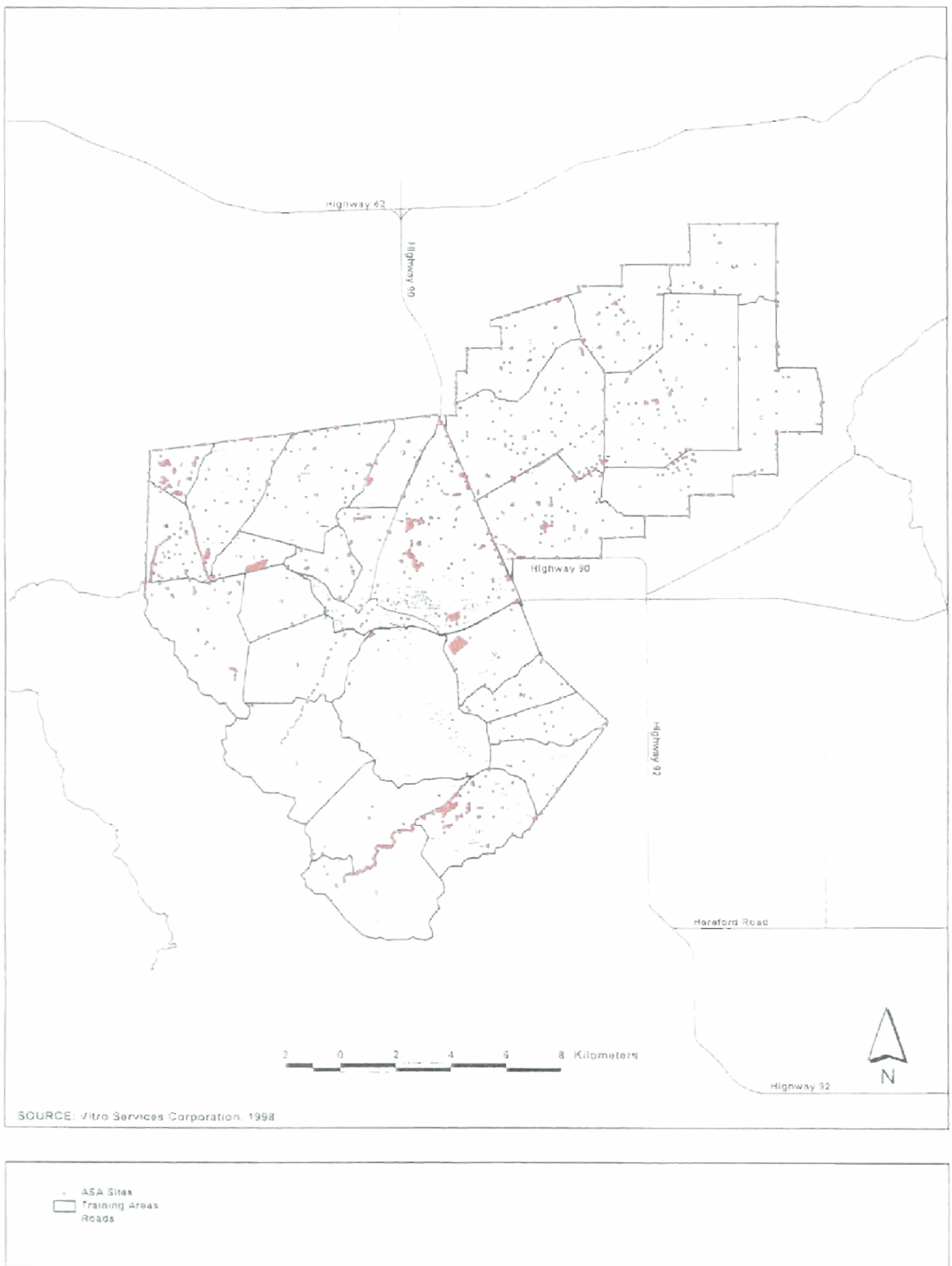
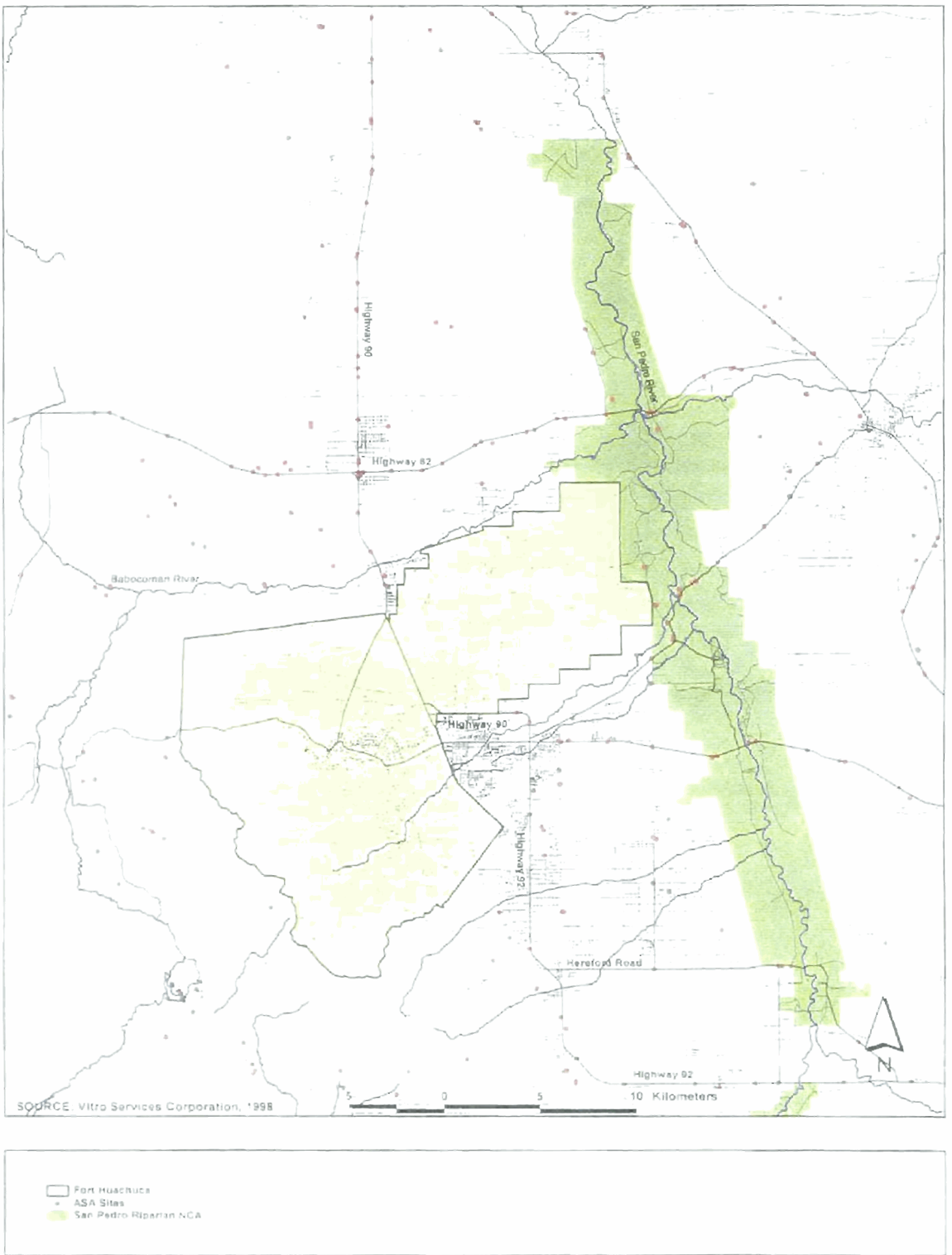


Figure 2: Fort Huachuca Off–Post ASA Sites



Communications Systems Training and Testing

Another major mission at Fort Huachuca involves radio systems training and testing. The physical components of the systems during training consist of a variety of satellite, troposcatter, high frequency, and microwave equipment to provide communications support. Portable equipment is moved on military 5-ton and 2-ton vehicles pulling a wide variety of generators, antennae, and trailers. During training, vehicles and personnel are deployed to a variety of preexisting sites across the installation. Typical exercises last from 7-14 days with 24-hour operations. Each field unit may utilize up to 40-80 vehicles, 50 generators, 12 communications shelters, and 80-100 soldiers per site, generally there are as little as 3 vehicles and 9 soldiers at each relay site (USAIC&FH 1992, USAIC&FH 1993). The maximum area covered by a unit during training can be up to 40 acres with 13 remote site locations per exercise. Large bivouac exercises occur in predefined areas used repeatedly for such activities with relay sites located across the installation. Predefined bivouac areas often include permanent structures and concrete pads for repeated bivouac establishment. Remote relay sites are located all across the installation. Sites selected for use across the installation must be approved by Range Control prior to use. Range Control may restrict the use of certain areas during high fire danger and enforce special regulations for areas within protected agave areas (see the Intelligence and Electronic Warfare Equipment Training and Testing subsection of the Description of the Proposed Action Section of this biological opinion).

Two types of larger exercises are also conducted: Battalion (Bn) and Brigade (Bde). Battalion level exercises are conducted 8-12 times per year and involve 160-200 personnel in which approximately 20 vehicles are used. Brigade level exercises are conducted 1-2 times per year and involve 400-500 personnel with approximately 150-200 vehicles used in such operations. There are no set timelines for testing activities. Tests are conducted year-round and may run 24 hours per day, 7 days per week, for as long as a month. Lately, portions of the brigade have been deployed extensively and training exercises have been reduced. These activities occur at similar sites to those mentioned previously for communications training. Range Control may restrict the use of certain areas during high fire danger and enforce special regulations for areas within protected agave areas.

Field Training Exercises

Fort Huachuca is used for training by various Fort Huachuca operational units, Army Reserve and Arizona National Guard units, Fort Huachuca partner organizations, Border Patrol, educational Universities, and Missouri National Guard units. All training activities requiring use of range facilities are scheduled, coordinated, and controlled through the Installation Range and Training Office. Field training exercises consist of land navigation, patrolling and tactics training, individual development training, and vehicle maneuver training.

On occasion, locations across the area are utilized by training units for setting up bivouacs containing sleeping, mess, and other related facilities for the execution of field training exercises. Specific bivouac areas vary from exercise to exercise and do not always coincide with existing ASA sites. Use of any site must be requested a minimum of 21 days in advance from Range Control with an eight-digit grid coordinate location.

No vegetation clearing is authorized during the establishment of a bivouac. Holes can only be dug into the ground with prior permission from Range Control. Concrete pads in some permanent bivouac areas are used for cooking purposes to prevent waste water from seeping into the ground in case of spills.

There are approximately 18 established bivouac areas on the installation (Figure 4). These sites are used on a more frequent basis for the larger scale communications testing and training activities. These larger bivouac areas (40 acres) are maintained as permanent areas of repeated use so as to minimize the need for additional large set up areas.

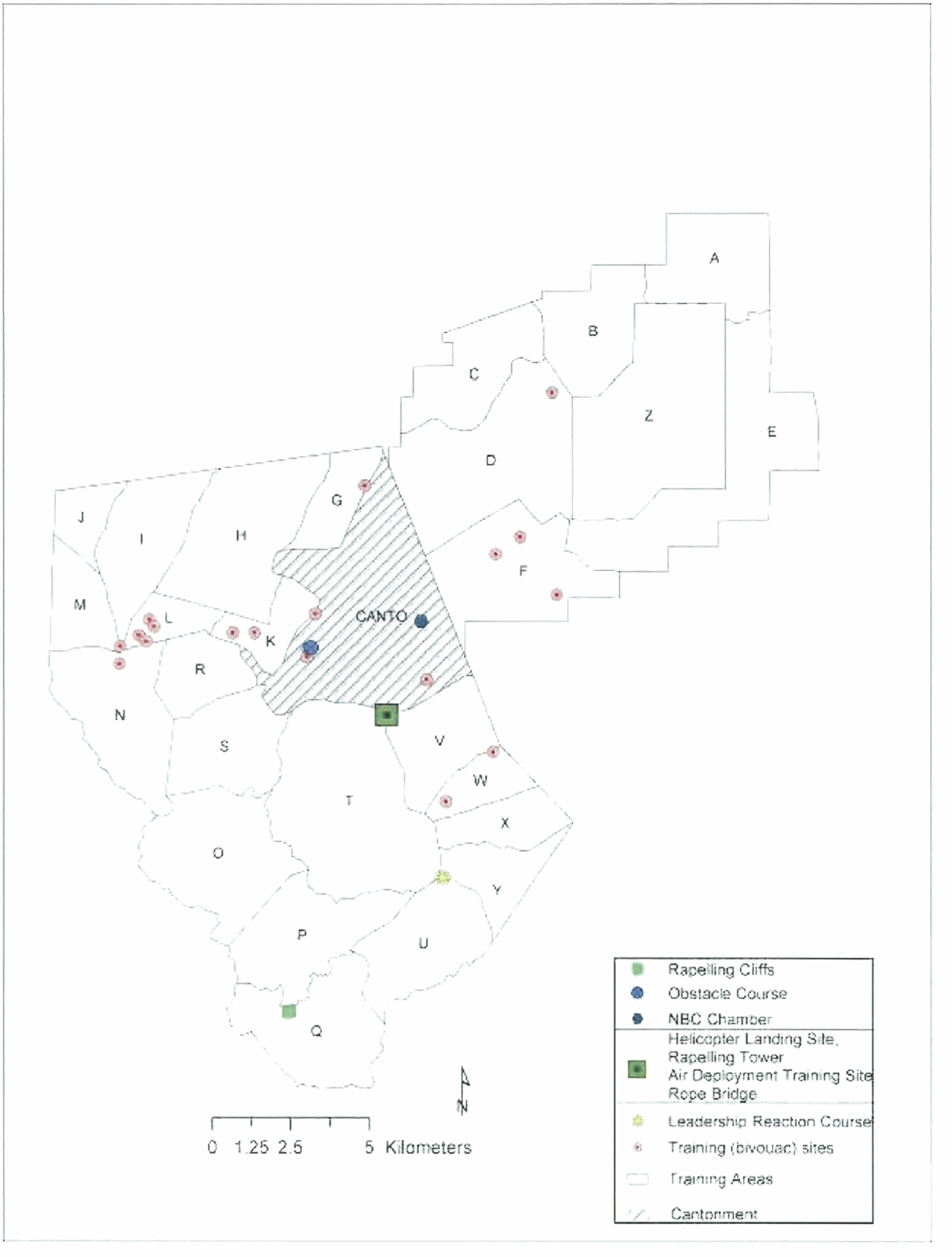
Land Navigation

Land navigation involves the training of personnel to accurately navigate the terrain on foot and locate pre-established sites and locations. Land navigation exercises typically involve 15-20 personnel and 4-5 vehicles for transportation of personnel to and from the field site. Operations generally last for one day from morning until evening and are conducted year around except in protected agave management areas as stated below. All vehicles are kept on existing roads and trails. There is no live fire, firing of blanks, or pyrotechnics permitted. There are two existing land navigation courses on the installation:

1. Land navigation course in Training Area Uniform consisting of 44 surveyed concrete points with ASA markers.

2. Land navigation course in Training Area Mike consisting of 58 surveyed concrete points with ASA markers.

Figure 3: Fort Huachuca Training Areas and Facilities



Additional land navigation training is conducted across the installation on the West and South Ranges. This training is similar to that which occurs on Land Navigation Courses. Vehicles are used to transport personnel to and from the field and are kept on existing roads, trails or parking areas at all times. There is no live fire, firing of blanks, or pyrotechnics permitted. Activities are conducted during day and night times, except within protected agave management areas where night operations are prohibited while the lesser long-nosed bat is present (minimum July 1 through October 31).

Patrolling and Tactics Training

Patrolling and tactics training occurs across the South and West Ranges. The exercises, which generally last three days, are conducted every month of the year. Approximately 50 personnel are involved in the operations each month. Ammunition used during these operations includes pyrotechnics, smoke, and M16A2 blanks.

In these training exercises, soldiers maneuver on trails and cross-country. They occasionally dig holes about 5 inches deep to bury sensors near the trails and major roads. All vehicles used during this training are kept on existing roads and trails.

Training may take place during the day or at night. No firing of blanks or pyrotechnics can occur within 0.25 mile of protected agave management areas. Firing of blanks is also prohibited if it is determined by Range Control or the Fort Huachuca Fire Chief that a fire hazard exists. Activities are conducted during day and night times, except within protected agave management areas where night operations are prohibited while the lesser long-nosed bat is present (minimum July 1 through October 31).

Occasionally, a Special Forces unit will request to conduct patrolling training in the Huachuca Mountains on Fort Huachuca. These exercises usually involve teams of less than 12 personnel. Personnel are provided training on environmental awareness, and are prohibited from making campfires or killing animals during their patrolling training. This type of training generally occurs once a year at Fort Huachuca.

Individual Development Training

Several individual development training facilities are located on the South and West Ranges and within the cantonment area including:

- a rappelling tower (Training Area Tango) - A two-level tower platform used for rappelling practice;
- a rappelling cliff (Training Area Quebec) - Cliffs located in Garden Canyon which vary in height from approximately 70-100 feet;
- a rope bridge Training Site (Training Area Victor) - An open area with four upright telephone pole tops, approximately four feet high;
- a Leadership Reaction Course (Training Area Yankee) - Eight stations, each depicting a situation which requires the negotiation of obstacles by an expedient means; and

- a Demonstration Hill (Training Area Kilo) - May be used to conduct various types of demonstrations.

- a Warrior Task Complex (Training Area 6) – Six stations, each requiring soldiers to negotiate obstacles using the Military Decision Making Process

These permanent facilities are used to train personnel from a variety of host and partner organizations (see Figure 3).

Vehicle Maneuver Training

Vehicle maneuver and driver training activities occur across the installation on various existing roads and trails. The majority of all vehicle maneuver training consists of wheeled-vehicles with occasional tracked-vehicle training. Wheeled-vehicle training maneuvers can include attaching and detaching trailers, loading and unloading equipment, and driver training across the installation. All maneuvering activities are confined to the existing roads and trails.

Oversized vehicles are restricted to roads; whereas light vehicles can use roads and trails. No cross country maneuvering or other use of existing off-road maneuvering lanes occurs or is planned except as described for the MO ANG below or emergency situations (safety, fire, etc.) All existing and planned operations will adhere to the following regulations/policies:

1. Follow Fort Huachuca Regulation 385-8, Safety - Range and Training Area Operations (October 3, 2006);

2. Follow guidelines set forth in the Installation Spill Contingency Plan - Fort Huachuca, Arizona (December 20, 1996); and

3. Submit Fort Huachuca Form 1155 (Revised August 1, 1993) through appropriate channels or use web based scheduling system RFMSS (Range Facility Management Support System) for approval prior to commencement of maneuvers which require access to the East Range.

Off-road vehicle travel is not currently authorized at any location on Fort Huachuca. Approximately 5,172 acres within the East Range (Training Areas Charlie and Delta) have been designated for off-road maneuvering lanes, but no off-road activity has occurred since 1994 (Figure 5). With the expansion of Humor DZ, and its use for dropping palletized loads from aircraft, approximately four short off-road recovery trips will be required for each of the 25 classes offered by the MO ANG. These would occur in Training Area Bravo, between the existing Humor DZ and Hubbard landing strip. No other off-road vehicle maneuver is presently occurring or is planned on the installation. If the off-road maneuvering lanes were to be used in the future, separate section 7 consultation would be initiated.

Figure 4: Fort Huachuca East Range Off-Road Maneuver Areas and Mortar Firing Points

Live Fire Qualification and Training

Most live fire activities take place on weapons qualifications ranges in Training Area Tango. Maximum ammunition and associated noise levels used on these ranges are listed in Table 1. Locations of these firing ranges and their associated safety fans are provided in Figure 6. When

conditions permit, tracer rounds are permitted on all live firing ranges with the exception of Ranges 2, 3, and 4.

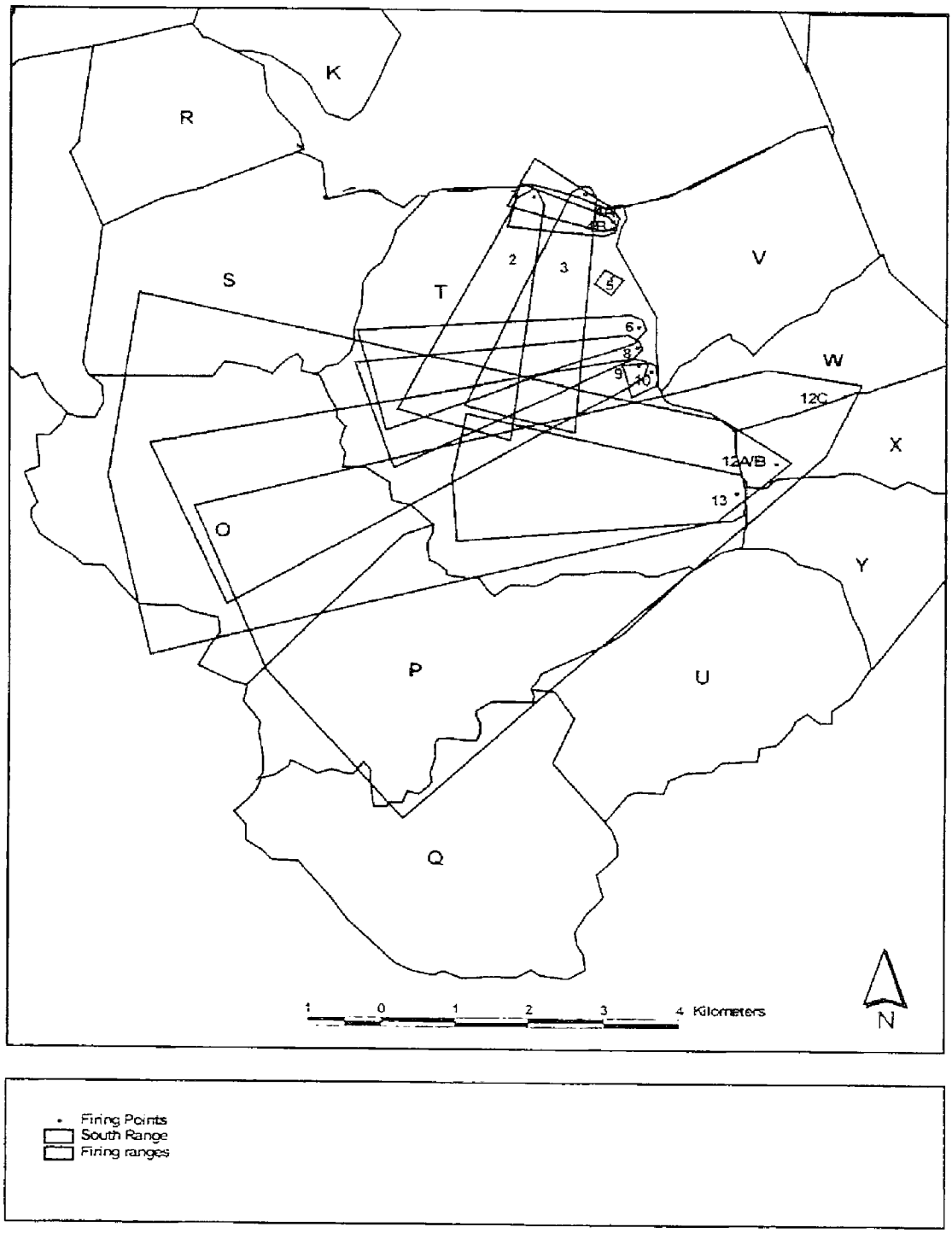
Table 1: Firing Ranges on Fort Huachuca

Range	Range Utilization	Maximum Ammo Permitted	Maximum Noise Level At Firing Point[1]
Range 1	Currently inactive	NONE	N/A
Range 2	M-16 Rifle Zero Range with 40 firing points and a target width of 100 meters.	5.56mm	156 dbP
Range 3	Small bore multi-purpose range with 15 firing points, and 75 meters maximum range.	7.62mm	156 dbP
Range 4	Pistol range complex consisting of a competition firing range with 25 firing points and target distances at 25 and 50 meters (Range 4A), and an US Army Standard Pistol Qualification course consisting of four firing points with target distances from 7 to 31 meters (Range 4B).	.45 cal	162 dbP
Range 5	High explosive hand grenade range with 12 firing points. Currently inactive, due to safety considerations.	M67 FRAG (ONLY)	171 dbP
Range 6	Fifty firing points and six firing lines from 100 to 1,000 yards.	.50 cal	159 dbP
Range 7	Currently inactive	NONE	N/A
Range 8	Automated record fire range with 10 firing points and target distances from 50 to 300 meters.	5.56mm	156 dbP
Range 9	Range 9A serves as a multi-purpose machine gun range with four firing points, Range 9B is used for recoilless rifles.	.50 cal, 106mm	160 dbP
Range 10	M-79 and M-203 grenade launcher range. High Explosive (HE) cannot be fired on this range.	40mm	154 dbP
Range 11	Currently inactive	NONE	N/A
Range 12A	.50 caliber, 7.62mm and 40mm live fire weapons range. HE ammunition cannot be fired on this range.	120mm, .50 cal	160 dbP
Range 12B	Tank gunnery range. HE ammunition cannot be fired on this range.	NONE[2]	N/A
Range 12C	Tank gunnery range. HE ammunition cannot be fired on this range.	NONE[2]	N/A
Range 13	M-16 marksmanship record fire range with 16 firing positions and targets from 50 to 300 meters.	5.56mm	156 dbP
Range 14	Currently inactive Squad attack course	NONE	N/A
Range 15	Currently inactive Platoon attack course	NONE	N/A

Sources: Hermann Zillgens and Associates (1991), Miller pers. comm. 2006 as cited in the Revised PBA

1. Based on impulse noise levels and do not represent steady noise or time-weighted average.
2. There is no tank gunnery firing currently authorized at Fort Huachuca.

Figure 5: Fort Huachuca Live Fire Ranges



Small Arms

Small arms qualification and live fire at Fort Huachuca occur on only ten of the 17 existing live fire ranges in Training Area Tango (Table 1) and on the convoy live fire course in Training Area Zulu on the east range. Firing positions and safety fans for these ranges are provided in Figure 6. Firing ranges are used for personnel qualification and training throughout the year. Live fire does not take place at night on Ranges 2, 3, and 4 while the lesser long-nosed bat is present (minimum July 1 through October 31). Range 9 was renovated in 2002, however, the overall use and footprint of the range did not change. Range 13 is scheduled to be renovated in 2006, however the overall use and footprint of the range is not anticipated to change.

Artillery and Mortar

The East Range contains several surveyed firing points usable for mortar and artillery firing into Impact Area Zulu (Figure 5). These points support 60 and 80 mm mortar, and 4.2-inch mortars, utilizing high explosive, illumination, smoke, and weapons piercing rounds for training. If use of areas outside of the pre-existing firing points is required, section 7 consultation would be requested.

Training activities which include use of the East Range for mortar firing are subject to Army Regulation (AR) 385-5 and must carry sufficient fire suppression equipment at all times in the event of a fire. Range Control regulations also require observation personnel to maintain constant watch during training activities for accidental fires resulting from mortar use on the East Range.

Administrative and Support Activities

The administrative and support activities performed at Fort Huachuca are those activities associated with the day-to-day operation of the installation and the ranges, inclusive of those activities performed by USAIC&FH, the directorates, and partner organizations. Several administrative and support organizations exist at Fort Huachuca to support the installation's ongoing role as a major Army testing and training installation. Personnel from these organizations are located in the cantonment area. They include those personnel associated with the CPOC and its recent expansion.

The US Army Garrison (USAG) at Fort Huachuca includes the Command Group; Protocol Office, Public Affairs Office; Chaplain Activities Office; Inspector General; Office of the Staff Judge Advocate; Joint Planning Group; Office of the Chief of MI; the Directorate of Public Works (DPW); Resource Management; Public Safety; Programs for Community Activities; Human Resources; Information Management; Contracting; Operations, Training and Doctrine; Evaluation and Standardization; and Combat Developments. The Garrison also includes a Department of Tactics, Intelligence and Military Science. These offices support more than 40 commands, agencies, and activities which reside across the installation. Each organizational element may contain additional divisions, branches, and sections. The offices and directorates are primarily located within the cantonment area.

AAFES provides support for many of the commercial needs of soldiers and their families. Currently, AAFES provides the following on-post locations for services: Main Post Exchange, Shoppette/Mini Mall with gasoline dispensing, Main Gate Shoppette/Mini Mall with gasoline

dispensing, several food service operations, laundry and dry cleaning services, Laundromat (self-serve), and Military Clothing Sales.

Aviation Activities

Aviation activities at Fort Huachuca include fixed-wing piloted aircraft training, UAV testing and training, unmanned drug surveillance balloon operation, and a small amount of rotary-wing aircraft use. Aviation activities generally occur at LAAF, a military-civilian joint-use facility located along the northern boundary of the cantonment area. The LAAF supports military aircraft involved in test and training programs, troop movements, and standard military, commercial and private travel operations. Three runways, several taxiways, aprons, and parking areas for fixed and rotary-wing aircraft cover the largest portion of the airfield area. Air operations are sustained by numerous support facilities which include a flight control tower, a navigational aids building, an airfield operations building, an airfield fire and rescue station, utilities support structures, and storage buildings. Air space used by UAVs at Fort Huachuca and restricted airspace over the installation is shown in Figure 7. Flight corridors and other aviation-related training areas at Fort Huachuca are shown in Figure 8 and include:

- a C-5A aircraft training mock-up (Training Area Victor) - a concrete platform depicting a C-5A aircraft cargo bay used to simulate cargo loading;
- an emergency helicopter landing area (Training Area Victor);
- helicopter landing areas for proficiency and emergency operations (Training Areas November, Romeo, India, and Kilo);
- the Hubbard Assault Airstrip (Training Areas Bravo and Delta) - a dirt assault strip/landing zone, surveyed and approved by the USAF, which can accommodate C-130 aircraft (675 x 1600 meters);
- the Hubbard DZ (Training Areas Charlie and Delta) 850 x 1700 meters;
- the Humor DZ (Training Area Bravo) 825 x 1660 meters (proposed expansion would increase dimensions to 1800 x 3000 meters);
- the Havoc DZ (Training Areas Charlie and Delta) 850 x 1700 meters; and
- the Hyena DZ (Training Area Echo) 300 x 300 meters.

Approximately 156,000 aviation evolutions occurred at LAAF between September 2004 and August 2005 (each landing or departure counts as one evolution each). Military operations include approximately 50,651 evolutions or 72 percent of all activity (of these, 50 percent were jet and 50 percent were propeller).

Figure 6: Fort Huachuca Regional Air Activities

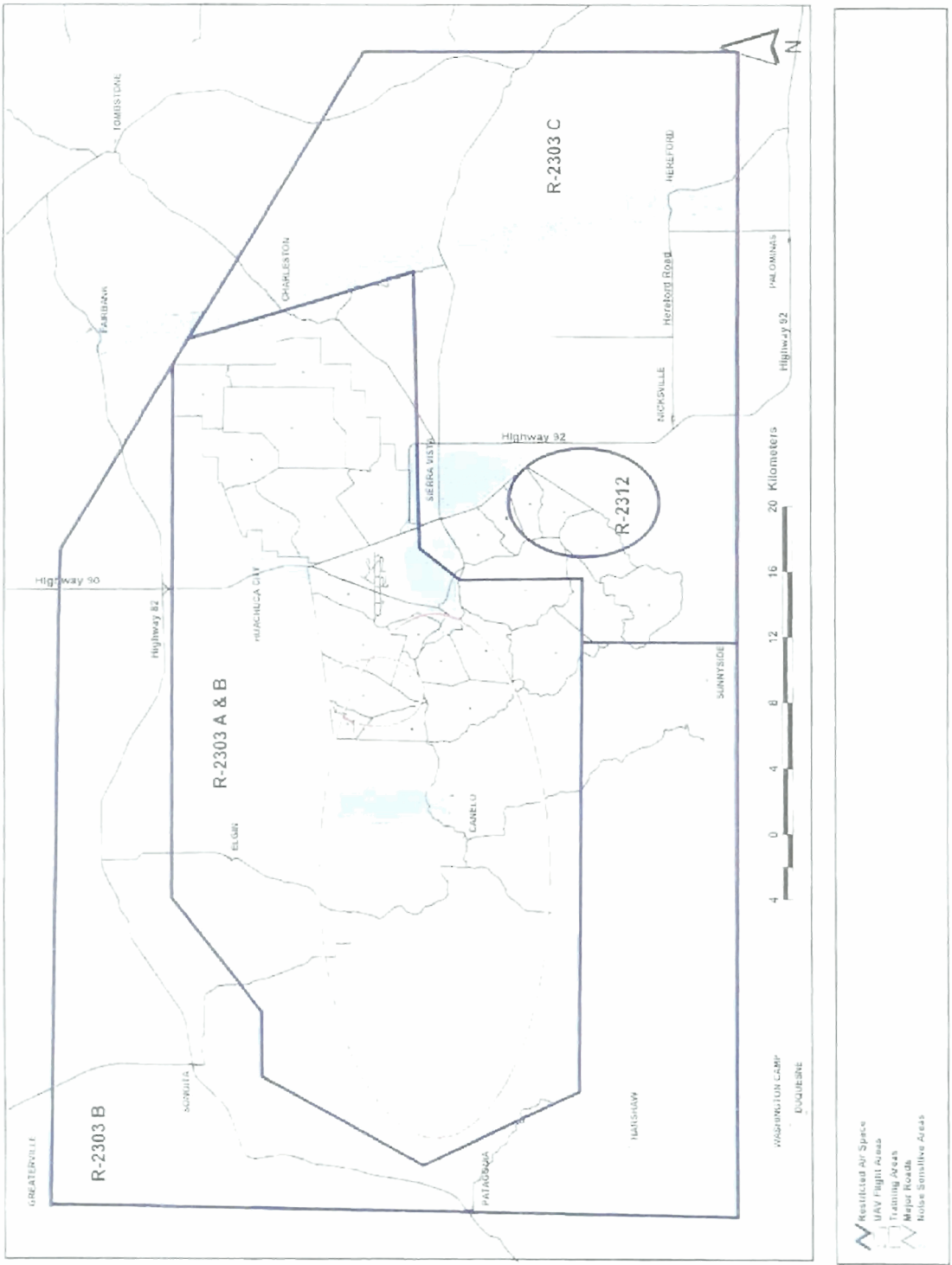
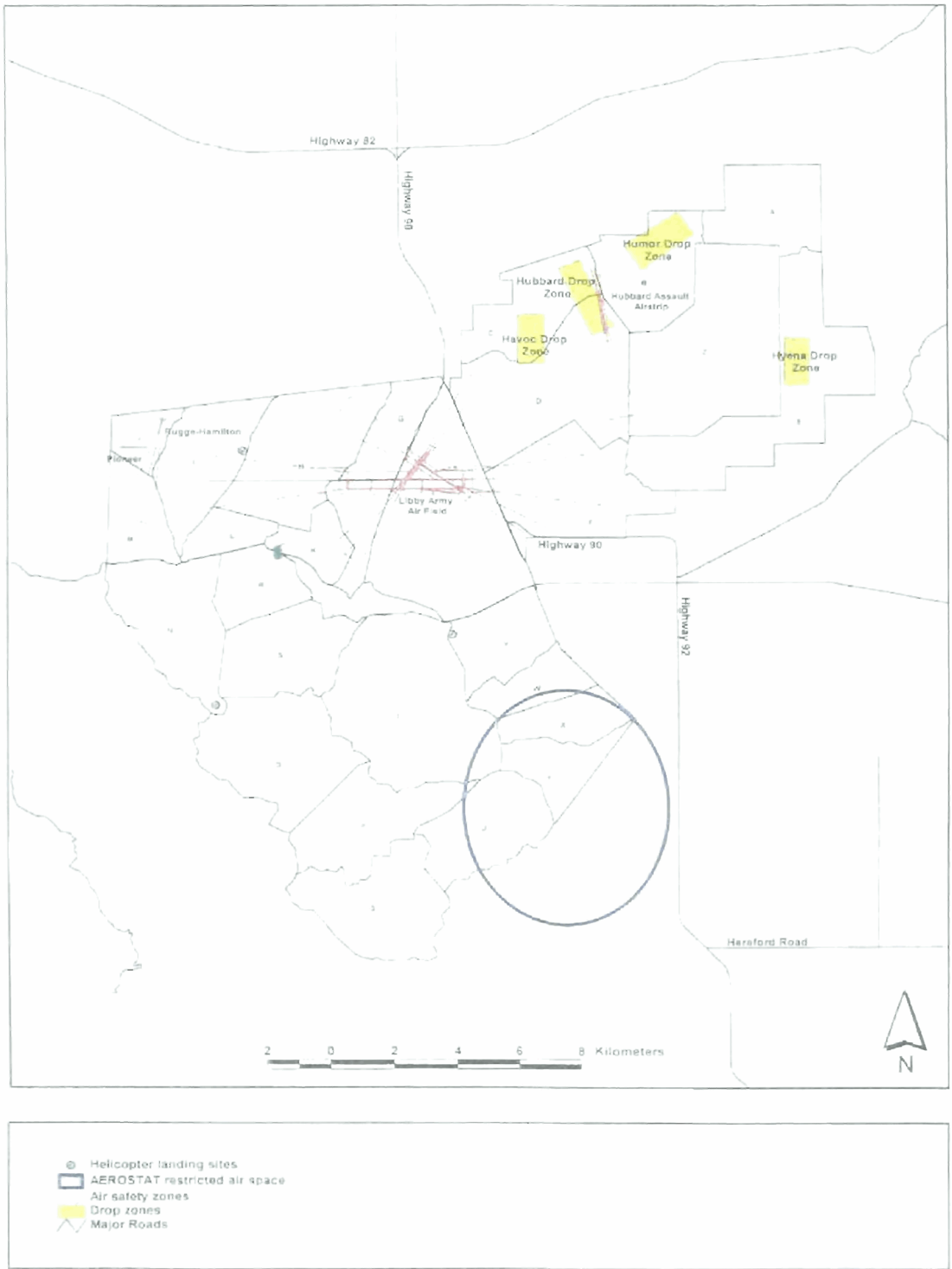


Figure 7: Fort Huachuca Air Safety Fans and Local Activities



Approaches to LAAF are considered Class D Airspace since the facility contains a manned operating control tower. The airport's airspace includes a horizontal radius of 4.3 statute miles of the airport, extending from the surface up to 7,200 feet mean sea level (msl). Aircraft are not permitted to enter the airspace until the Air Traffic Control (ATC) tower is contacted for clearance to do so. During the time the ATC tower is closed, the airspace reverts to Class G, or uncontrolled airspace.

Restricted areas contain airspace identified by an area on the surface of the earth within which the flight of aircraft is subject to restrictions. If the restricted area is active, the ATC facility having jurisdiction over the airspace needs to authorize clearances to aircraft that cannot avoid the restricted area, unless the aircraft is on a previously approved altitude reservation mission or is part of an activity within the restricted area (Coffman and Associates 1995). If the restricted area is not active and has been released to the controlling agency (Federal Aviation Administration (FAA)), the ATC facility will allow aircraft to transition through the airspace without issuing special clearances. Four restricted areas, R-2303A, R-2303B, R-2303C, and R-2312, are located in the vicinity of LAAF. Flight operations originating at LAAF (i.e., helicopter, fixed-wing, and UAV operations) utilize only small portions of this airspace.

Other fixed wing activities at LAAF include tenants at Fort Huachuca, such as the US Forest Service Air Tanker base and the US Border Patrol border surveillance activities. Occasionally, other agencies use LAAF on a temporary basis, including North Atlantic Treaty Organization (NATO) partner aircraft, transient USAF operational aircraft, and civilian air shows.

Fixed-Wing Piloted Aircraft Training

Fort Huachuca airspace and facilities are used by other DoD agencies for proficiency testing and training during exercises originating at other installations. USAIC&FH is not the proponent for any military fixed-wing piloted aircraft training activity based at Fort Huachuca or any other installation. The following summary discussions represent aviation activities that utilize Fort Huachuca airspace or facilities during training or testing operations.

Individual pilot proficiency training for the USAF and USAF Reserve is conducted in Fort Huachuca airspace and at LAAF facilities. The most common aircraft is the ground attack A-10 aircraft flown out of Davis-Monthan Air Force Base in Tucson. These A-10s averaged 30,000 flight evolutions at LAAF for calendar years 1993-2005, for an average of 35 percent of the annual military activity at the airfield. This training consists of low altitude touch-and-goes (simulated aircraft landings and take-offs where aircraft are flown to LAAF and make approaches to the airfield, simulate a landing, and depart without actually grounding the aircraft). The LAAF air zone used during this activity is shown in Figure 8. The Arizona Air National Guard (AZ ANG) and MO ANG use Fort Huachuca airspace and LAAF facilities on a continuous basis for individual proficiency training for pilots. The AZ ANG maintains a training center on post for the MO ANG's training course: Advanced Airlift Tactics and Training Center. They have five C130s and/or C17s at a time, 25-26 training classes per year. All personnel are qualified on their aircraft (i.e., the pilots are qualified to fly their aircraft already), and they are learning to evade surface to air fire, drop pallet loads from the aircraft, avoid detection, etc. The AZ ANG 162nd Fighter Group headquartered in Tucson, uses LAAF for instrument approach procedures, missed approach procedures, instrument departure procedures, and touch-and-go takeoffs and landings. Most training is conducted using the Lockheed C-130 aircraft, a four-engine turboprop powered tactical transport. Other similar turboprop transports, such as the two-

engine Transall C-160, are used by some training units. The AZ ANG and MO ANG aircraft have used LAAF for an annual average of 40,000 flight evolutions, or approximately 40 percent of the annual military activity at the airfield.

Drop zones (DZ) on the East Range and the Hubbard Landing Zone are used by the AZ ANG and MO ANG as training flight destinations/objectives where actual airdrops or landings can be practiced. The Hubbard Landing Zone provides tactical airlift crews a rare peacetime opportunity to land and takeoff from a dirt runway. The Hubbard Landing Zone is presently used by each training aircrew for four landings and takeoffs during the class period. Annual operations for the landing zone are approximately 720 evolutions. The Missouri Air Guard has recently requested an expansion of the Humor DZ to accommodate air drops of palletized loads. The expansion would increase the size of the DZ to 1800 x 3000 meters. The Hubbard Landing Zone air zone used during this activity is shown in Figure 8.

The DoD in cooperation with the FAA is proposing to replace the current air surveillance radar at Fort Huachuca within the next three years. A new location has been selected and a site survey completed.

Unmanned Aircraft Systems Training Battalion (UASTB)

In general, Unmanned Aircraft Systems (UAS) are large remote-controlled aircraft that have a 10-60 feet wingspan and are approximately 10-40 feet long. The following activities incorporated into the proposed action are:

1. Deployment of the Medium Tactical UAS (Shadow) in 2001. The Unmanned Aircraft Systems Training Battalion (UASTB) will continue to train soldiers during the fielding of the Shadow Systems until approximately 2013. Beyond that the UASTB will train Shadow operators to sustain the Army's manpower requirements for the life of the system. At this time we don't know what the life span of the Shadow System will be. Training on the Hunter UAS is estimated to continue until 2010. The UASTB will start training soldiers in the new and larger Extended Range/Multi Purpose UAS in mid 2008.

2. The facilities at the UASTB have been upgraded. A 2000 foot paved runway and a maintenance hangar (Bldg no. 11680) were built in 2000. Another maintenance hangar (Bldg no. 11683), a new maintenance operations building (Bldg no. 11682), an operations building (Bldg no. 11691), and parking lot were built in 2005. An additional 7000 square feet flight simulator building (Bldg no. 11645) was completed in 2006. The Applied Instruction Building at Black Tower is approximately 32,000 square feet.

3. The UASTB has requested Military Construction Funds (MCA) to build a facility that will eventually house and feed up to 300 soldiers. The proposed facility would consist of three barracks buildings, each housing 100 soldiers, a dining facility, and a fire station/ambulance station. MCA projects normally take five to seven years to complete, if approved; Fort Huachuca estimates this project would start construction in 2013. If emergency construction funds are appropriated by Congress then this project could be built within one or two years. The Border Patrol may potentially vacate Hangar One, however, if it is not vacated, then construction of another hanger for Unmanned Aircraft Systems (UAS) at Libby Army Airfield to house the new Extended Range/Multi Purpose (ER/MP) UAS is planned. In addition to the construction of a new hangar, there will be a

need to upgrade the aircraft parking apron located northwest of Hangar One at Libby. The Army will start fielding the ER/MP in 2009, the UASTB has to be ready to start flying (training) ER/MP not later than mid 2008.

4. Increased frequency of training flights. The proposed action includes an anticipated increase of 30 percent in airspace use of R-2303A. The ER/MP, Hunter and Shadow Aircraft Systems are expected to fly approximately 300 days every year. The Hunter system will fly an average of four hours daily, the ER/MP will conduct day and night training flights that will average approximately 8 hours during the day shift and another 8 hours during the night shift. The Shadow System is expected to continue flying an estimated 8 hours per shift, two shifts daily.

5. Fort Huachuca currently supports the operation and training of the Shadow and Hunter UAS. These UAS normally fly at altitudes between 10,000 and 13, 000 feet above mean sea level (MSL). The West Range ground elevation varies, however using an average of 5000 feet, the UAS will be flying at an approximate altitude of 5000 to 8000 feet above the ground level (agl). During testing and training activities, the minimum altitude at which UAS fly (excluding take off and landing approaches) is 1,000 feet agl. Generally, UAS operate above the West Range and to the west of Fort Huachuca. Typical flight paths for these UAS are shown in Figure 7. The UAS training is conducted at the Applied Instruction Building (AIB) (Bldg 11640), and Rugge-Hamilton flight line, approximately 9.7 km (6 miles) west of the cantonment area on the West Range. The UAS training battalion operates on the West Range from approximately 0500 hours to 2300 hours, however, during the rainy season the operating hours may vary to adjust for inclement weather. The UASTB uses equipment such as UAS, ground control stations, 2.5 ton trucks, 5-ton trucks, mobile power units, and communication antennas.

6. The mission is to train UAS operators for the US Army. Operational proficiency training involves a field training exercise at Hubbard Airstrip lasting a week or less and is conducted at the end of each UAS operator course. Currently, an average of 18 Shadow operator classes are graduating annually. Additionally, there is a requirement to train Hunter operators to sustain the manpower requirement of Hunter units Army wide. The personnel requirement varies but the average is one class of twenty operators annually. The Hunter class will also conduct a one week field training exercise at the end of the course. Hubbard airstrip is also used by the personnel from the New Systems Training and Integration Office (NSTIO). When a Shadow system is fielded a UAS platoon will come to Fort Huachuca to receive their equipment and go through the New System Training (NET). The field exercise portion of the training lasts five weeks. The units move between Hubbard and Pioneer Airstrips depending on availability of the training areas. Approximately 35 personnel will be involved in this field training exercise.

7. Pioneer Airstrip is utilized by the Shadow Program Manager (PM) Office to conduct testing and acceptance flights of Government Shadow Systems. The number of daily flights and personnel at the site will vary according to the needs of the Army. Pioneer Airstrip is typically day use only with normal operating hours of 0730 to 1630.

Other UAS activities on Fort Huachuca may include activities similar to those described above using either smaller UAS or larger UAS. At this time, only testing activities using these sizes of

UAS occur at Fort Huachuca. The Comprehensive UAS Testing and Training EA, June 2000, describe these activities and is incorporated by reference.

Unmanned Drug Surveillance Balloon Operation

In 1987, an AEROSTAT Drug Surveillance Balloon became operational in the southern portion of the South Range. The blimp-type balloon is ground tethered and is an aerial platform for radar equipment used to detect aircraft illegally entering the US (Hermann Zillgens and Associates. 1991). They provide radar data for US Customs, the DoD, and the FAA. They operate year round, 24 hours per day within approximately nine hectares (23 acres) of the South Range. Airspace used for the AEROSTAT balloon is shown in Figure 7 and Figure 8. This airspace is restricted only for AEROSTAT activities.

Recreational Activities

Southeastern Arizona is a popular destination for local visitors, as well as national and international travelers. The addition of the San Pedro RNCA, the Scenic Railroad, Coronado National Forest, Coronado National Memorial, Ramsey Canyon Preserve, Kartchner Caverns State Park, and other unique tourist and recreational attractions further enhance visitor interest in Cochise County. Although current recreational use in the Sierra Vista area is mostly concentrated in areas just outside the Fort (Ramsey and Carr Canyons and the SPNRCA), Garden, Huachuca, and Scheelite Canyons on Fort Huachuca are additional popular recreational sites. With the development of Kartchner Caverns State Park, recreational interest throughout the area is expected to grow with an emphasis on scenic, natural, and cultural resources.

Recreational Activities at Fort Huachuca

Recreational use of Fort Huachuca lands has increased in recent years along with the general increase in tourism throughout the Cochise County area. Fort Huachuca is open to the public, and areas outside the firing ranges and impact areas are available for recreational activities. The variety of natural and recreational resources in the Fort Huachuca area, especially for bird watching and hiking, suggest that interest in these resources will continue to grow. Popular activities at the Fort include bird watching, hiking, horseback riding, golfing, and hunting. Generally, recreational activities are unrestricted but portions of the Fort may be closed to the public during military training activities. Civilians participating in recreational activities can gain access to the installation by showing a photo identification card and registering their vehicle at the main or east gate to obtain a vehicle permit.

Public access to recreational areas may be prohibited by the Range Control Officer due to ongoing training and testing activities. As a result, some or all of Fort Huachuca may be closed to recreational activities on any given day.

Hunting and Fishing

Mule deer, white-tailed deer, pronghorn, javelina, bear and mountain lion are historically the big game species hunted at Fort Huachuca. Hunters also have the opportunity to hunt three species of quail, two species of dove, and several other small game species. There are 30 hunting management areas on Fort Huachuca (Figures 9 and 10). Fort Huachuca hunting seasons and bag limits are set in coordination with the Arizona Game and Fish Department (AGFD).

There are 16 ponds (approximately 32 acres) located on the Fort (Table 2). Most of the ponds are dry and only retain water during heavy rains. Until 2002, seven of these ponds were stocked with trout when water conditions were favorable, and they were open for fishing during daylight hours only. Fort Huachuca has supported a very small fishing program in recent years because of the current drought conditions. Fishing on Fort Huachuca is allowed with a valid Arizona fishing license and Fort Huachuca fishing permit. The use of live bait (i.e., salamanders, fish, frogs, and crayfish) for fishing on Fort Huachuca is prohibited (Appendix C in the Revised PBA).

Hunting and fishing programs are covered by the 2001 Fort Huachuca Integrated Natural Resource Management Plan (INRMP) [Environment and Natural Resources Division (ENRD) 2001] (Appendix M in the Revised PBA).

Hiking, Camping, and Sports

- Lower Garden Canyon picnic area has ten sites with tables and grills and is open to self-contained recreation vehicle and tent camping. The area includes a comfort station, playgrounds, and a ramada for protection from the sun and rain.

- Middle Garden Canyon picnic area has picnic tables, grills, a playground, and a ramada.

- Upper Garden Canyon picnic area has picnic tables, grills, a playground and a ramada.

- The Golf Course has 12 picnicking sites with tables, grills, and ramadas. A comfort station and softball field are located on site.

- Apache Flats Recreational Vehicle (RV) Park has 50 spaces for RVs with electricity, picnic tables, grills, and a dump station. Water is available at all 50 spaces.

- Split Rock cabin is available for rental if fire conditions permit.

- Garden Canyon Cabin near Sawmill Canyon is available for rental if fire conditions permit.

Figure 8: Game Management Areas – Main Post

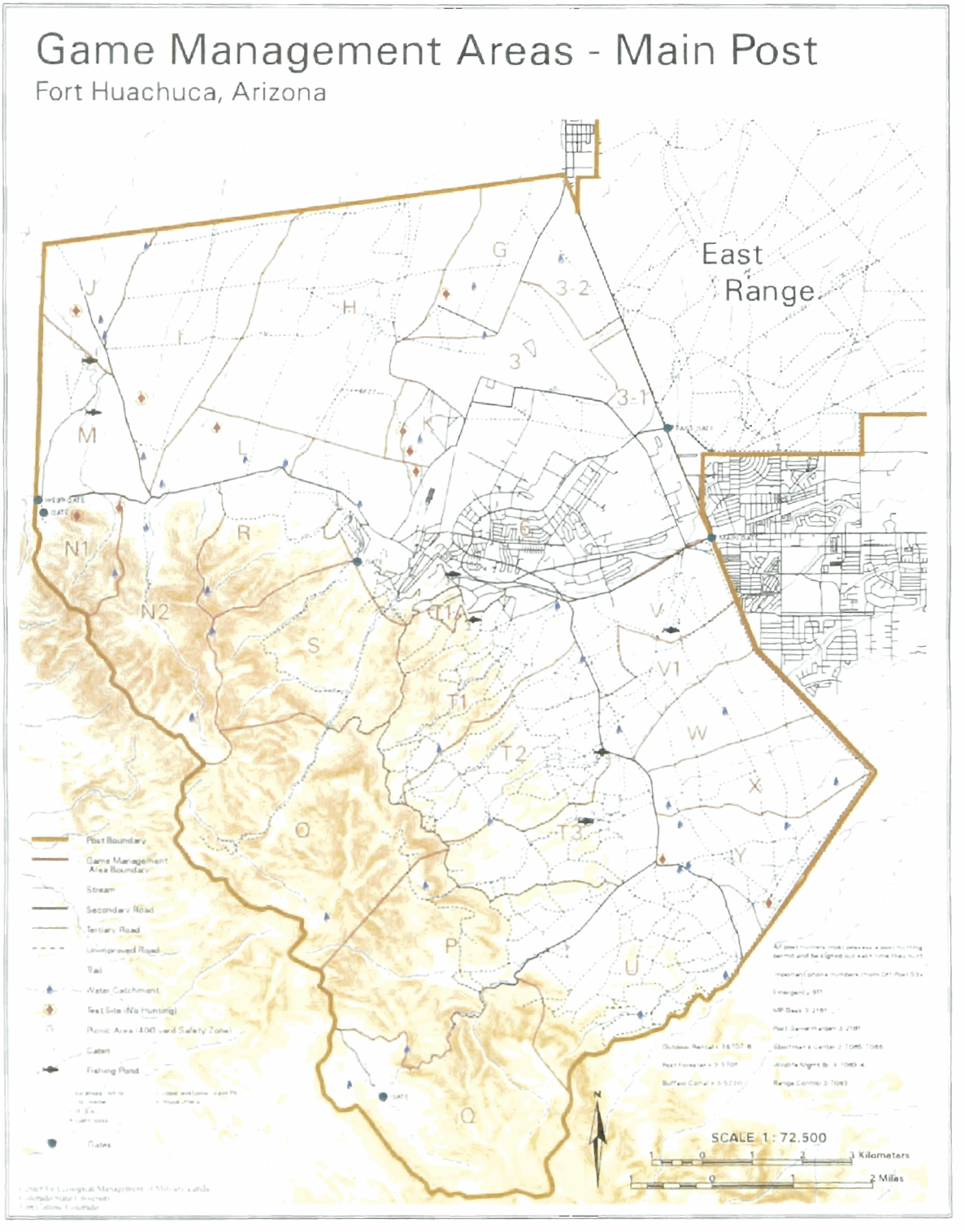


Figure 9: Game Management Areas – East Range

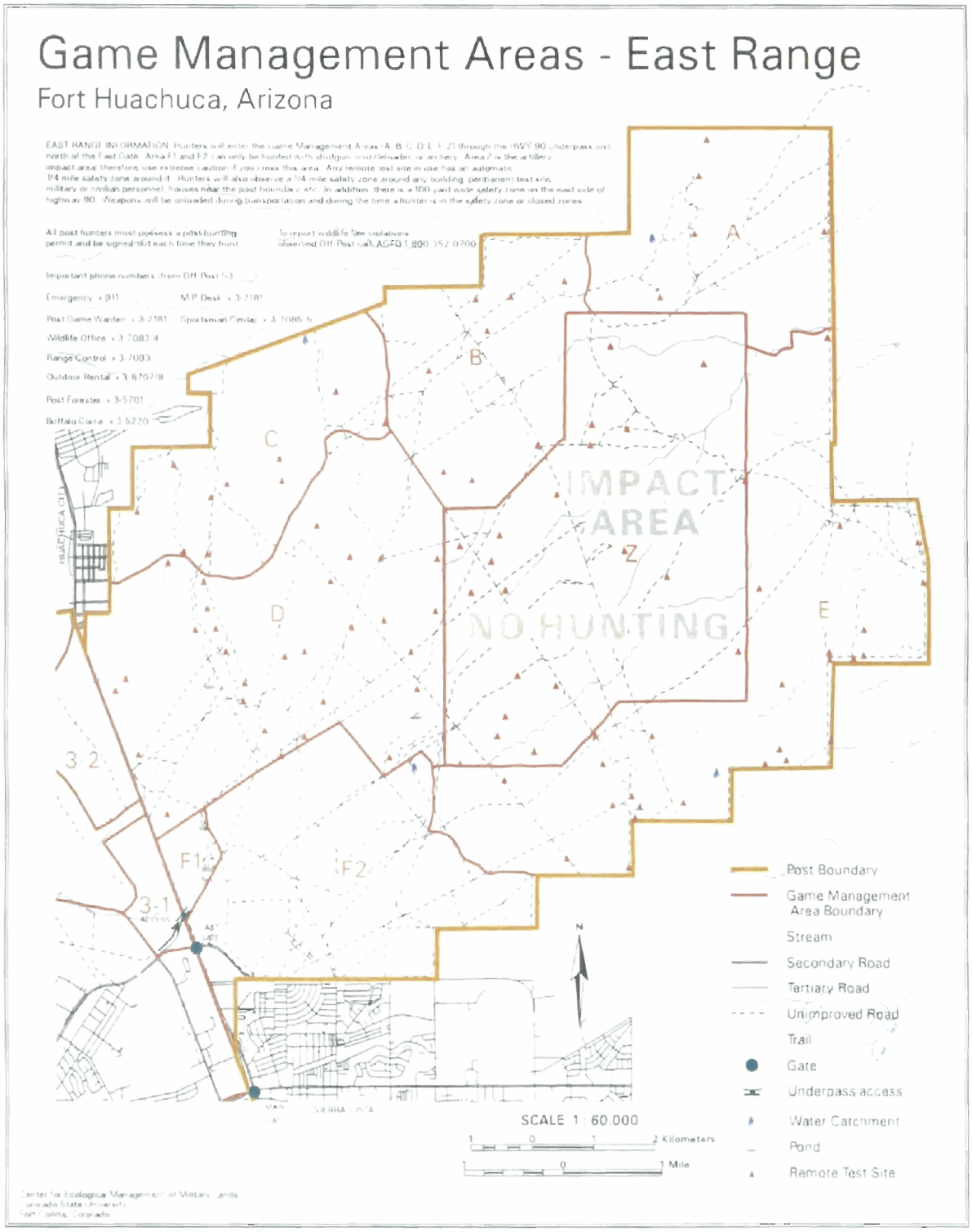


Table 2: Ponds of Fort Huachuca

Pond	Game Management Area	Size (Sq. Acres)	Depth
Golf Course	V	5	>14'
Officers Club	Cantonment	3	>15'
Gravel Pit	T-2	5	>13'
Woodcutters	T-3	2.5	>15'
Fly	T-1	3.25	5'
Lower Garden	Y	2.5	8'
Middle Garden	U	2	8'
Sycamore I	H	2.5	15'
Sycamore II	J	1.75	7'
Tinker Canyon	U	1	8'
Blacktail	N-2	1.5	- -
Hidden	I	0.75	2.5'
Antelope	I	1.5	2'
Laundry Ridge	K	- -	- -
Upper Garden	Q	- -	- -
Kino	M	- -	- -

Garden and Huachuca Canyon areas offer a wooded site for picnicking away from the main post. Reservoir Hill offers a spectacular view of much of the San Pedro Valley. Camping on post is permitted only in designated campgrounds. Canyon areas are accessible only during daylight hours.

Approximately 72 km (45 miles) of hiking trails are available on the Fort. Some of these connect with Forest Service trails and provide hiking access to other portions of the Huachuca Mountains, including the Miller Peak Wilderness Area.

Recreational rock climbing and rappelling is prohibited. An existing 18-hole golf course serves both military and civilian personnel and is located on the eastern end of the cantonment area just south of the Main Gate. Recreational caving is permitted in specified caves when the lesser long-nosed bat is not present on the installation.

Horseback Riding and Grazing

Horses can be rented by the hour or by the day at the Buffalo Corral Riding Stables located on West Gate Road. Boarding of privately owned horses is also available. Three areas are used for grazing horses at Fort Huachuca. These three areas support approximately 50-60 horses. Use of these areas is rotated on a 12-18 month rotation schedule.

Pasture A is approximately 946 acres and is used on an infrequent basis from May to October. Pasture B is approximately 175 acres and is used between the months of March and May. Pasture C is approximately 312 acres and divided into two sections with rotation between the two. Horses are grazed in Area C from May to October. At other times, horses are kept in the corral and are not grazed.

Horseback riding is authorized across the installation with the exception of firing ranges (when in use), impact areas, and areas of the installation with sensitive species.

Integrated Natural Resources Management and Fire Management Planning

In accordance with Public Law 105-85, the Sikes Act Improvement Act of 1997 (16 U.S.C. 670 *et. Seq.*), Fort Huachuca plans to review the INRMP that was completed in November 2001 (Appendix M in the Revised PBA), to ensure that the plan continues to help guide natural resources management on Fort Huachuca while supporting Fort Huachuca's military mission. The INRMP ensures that natural resource conservation and military activities are integrated and consistent with Federal stewardship requirements. The INRMP includes planning for inventory and monitoring, vegetation, wildland fire management, agave management, erosion and nonnative species control, and recreational management. The INRMP and all of its components, to include the Fort Huachuca Agave Management Plan (Appendix D in the Revised PBA), are included in the Revised PBA as part of the proposed action.

An Integrated Wildland Fire Management Plan (IWFMP) for Fort Huachuca was completed in January 2006. The IWFMP and all of its components are part of the proposed action (see Appendix N of the Revised PBA). The goals and objectives for fire management on Fort Huachuca are summarized below:

1. Protect life as the highest priority.

    a. Provide for the safety of army personnel, dependents, employees, visitors, and fire staff.

    b. Maintain a qualified and properly trained fire staff.

    c. Reduce fuels that threaten high-use areas.

2. Protect installation and personal property.

    a. Reduce fuels that threaten high-use area.

    b. Coordinate structural and wildland fire operations.

3. Manage fire to support military training.

    a. Conduct fire operations to reduce potential for catastrophic fires that disrupt training regimes.

    b. Conduct suppression activities to minimize adverse effects on training areas.

    c. Conduct prescribed fire activities to minimize restrictions on live fire ranges.

4. Manage fire to benefit natural resources.

    a. Allow fire to be a dynamic ecosystem process.

    b. Use fire to improve and sustain habitat of federally listed and other sensitive species.

    c. Minimize adverse effects of fire and suppression activities on natural resources.

5. Manage fire to benefit historic properties.

    a. Minimize adverse effects of fire and suppression activities on archaeological sites, historic structures, ethnographic resources, and cultural landscapes.

    b. Use prescribed fire to reduce fuels around sensitive resources and maintain landscapes.

    c. Take advantage of surveying opportunities during and after fire operations.

6. Coordinate fire operations with other installation divisions and neighboring land owners.

    a. Bring together structural and wildland fire planning operations.

    b. Maintain communication and educate the neighbors about the fire programs.

    c. Maintain formal agreements and conduct joint fire management activities with cooperators.

    d. Continue to actively participate in the Huachuca Area Fire Partners (HAFP).

Fort Huachuca's IWFMP identifies four strategies that play important roles in wildland fire management at Fort Huachuca:

- Wildland suppression is applied via appropriate management response around high-use developed and training areas and certain sensitive resources needing protection.

- Prescribed fire is used to reduce fuels in high-risk areas and accomplish ecological goals.

- Wildland fire use allows natural ignitions to burn when they meet predetermined prescriptions related to safety and ecological goals.

- Non-fire applications – most notably thinning and herbicides – are treatments that are used instead of prescribed burning in areas where fire is inherently unsafe or undesirable given current fuels conditions.

Fire Management Units (FMUs) are areas that apply certain sets of the above fire management strategies. The units defined for Fort Huachuca integrate into the FMUs specified for the Huachuca Area Fire Partners (HAFP). There are three FMUs for the installation:

- FMU 1: areas where wildland fire would be suppressed, but all other strategies available
- FMU 2: areas allowing suppression and non-fire treatments only (around perimeter)
- FMU 3: areas permitting all strategies

FMU 1 consists of areas where the risks to people, developments, and sensitive resources from prescribed fire are deemed manageable, while in FMU 2 risks are deemed too great, and only suppression and non-fire treatments are allowed. FMU 3 permits wildland fire use under predetermined conditions as well as the other strategies.

Fort Huachuca's IWFMP includes the use of prescribed fire as a tool to pretreat the landscape to prepare for the return of fire as a natural process. Such fires become the process when lack of ignitions and restrictive conditions prevent wildland fire use. Benefits of prescribed fire include support for military training, structure protection, and reduction in severity of future wildfires that might otherwise damage sensitive plant and animal communities, promote erosion and sedimentation, and negatively affect sensitive historic properties. Prescribed fires frequently take place outside the natural fire season. The IWFMP for Fort Huachuca proposes a 10-year program of prescribed burns.

Guidance for fire planning, as well as other fire management activities included in Fort Huachuca's IWFMP, is summarized below:

1. Policies to be followed in fire management include:

    a. Protection of life (firefighter and public) is the first priority. Property, military training, and natural/cultural resources (including endangered species protection) are second priority.

    b. Each prescribed fire shall be compatible with approved military training, public safety, or resource management objectives.

    c. The use of prescribed fire shall be considered in establishing the management strategy for all ecosystems, particularly those determined to be partially or totally fire dependent.

    d. Adoption of the National Wildfire Coordinating Group (NWCG) and Department of Homeland Security National Incident Management System (NIMS) standards for wildland and prescribed fire management positions to provide qualified and certified personnel for wildland and prescribed burning.

    e. Public health and environmental quality considerations will be incorporated into the use of managed wildland fire.

f. The Fort Huachuca IWFMP will be reviewed on an annual basis and formally evaluated and reaffirmed every ten years or less. Monitoring results from burns will be used in assessing the plan and making necessary revisions.

g. All areas with burnable vegetation will be allowed fire occurring at a reasonable return interval, except where occupied by human settlement. All areas below Charlie Break will be managed under a cooperative agreement by Fort Huachuca and Forest Service, while wildfires above Charlie Break will be managed primarily by the Coronado National Forest under existing MOA (Figure 11 in the Revised PBA).

h. Fires occurring in areas of human settlement (i.e., administrative sites, historic structures) will be suppressed immediately.

i. Fort Huachuca's fire management policy in military training areas below Charlie Break is one of prescribed burning coupled with control of fires that occur in or near structures and/or occur in the grasslands and savannas outside of prescribed parameters. Ignitions started by tracer fire will be managed to consume fuels throughout the entire Small Arms Impact Range Area in a safe, prescribed manner.

j. The Forest Service and Fort Huachuca policy for woodlands and forests above Charlie Break allows for unplanned ignitions and management-ignited prescribed burning, as well as suppression (confine, contain, control) when appropriate. Charlie Break runs roughly from the junction of Training Areas November, Romeo, and Sierra southeast to a point on the south boundary of Training Area Uniform.

2. Prescribed (natural or ignited) fire shall be managed in accordance with the following guidelines. Implementation of prescribed fire will be contingent upon compatibility with daily military operations, training, availability of funding and resources, and occurrence of correct burning conditions.

   a. For each prescribed fire, Fort Huachuca will develop a prescribed burn plan that will include a description of the burn area, burn objectives, public safety issues, protection of sensitive features, range of expected results, weather and fuel conditions needed to achieve the desired fire behavior, containment procedures, pre-burn coordination (e.g., with the FWS and the Coronado National Forest), monitoring plan, smoke management plan, and contingency plan.

   b. The goals of prescribed burns on Fort Huachuca will include: 1) reducing fuel loads in military training areas to reduce the possibility of catastrophic fires; 2) maintaining or improving wildlife habitat, including improving pronghorn antelope range away from firing ranges to reduce antelope foraging in burns near firing ranges; 3) reducing the risk of catastrophic fires in habitats used by federally listed threatened, endangered, and candidate species; 4) decreasing the likelihood of major fires in upper elevations that can cause an increase in

erosion and decrease in water infiltration/recharge of aquifers; 5) reestablishing the natural frequency/intensity of fires that would sustain the flora and fauna biodiversity of Fort Huachuca; 6) reducing the potential for fire to spread into the Fort's urban interface areas; and 7) minimizing the threat of fire to the Fort's historical buildings and archeological sites.

3. Subject to available funding and resources, the Fort will take action to reduce woody fuels above Charlie Break. Fuel reduction could be accomplished by mechanical means, such as pruning and thinning; as well as prescribed fire.

4. Fort Huachuca is implementing the IWFMP to address suppression needs and prescribed fire. The plan includes guidelines related to: resource personnel responsibilities; adjacent landowner responsibilities; fuels management; climatic monitoring; prescribed burning; smoke management; firebreaks; pre-suppression; and training, research, and equipment needs.

5. Post-wide wildfire suppression activities will include the following five fire management measures to prevent fires and aggressively control wildfires if they occur:

    a. Provision of fire suppression trucks on-site during live fire exercises when deemed necessary by the Range Control Officer and the Fort Huachuca Fire Department.

    b. Maintenance of required firebreaks.

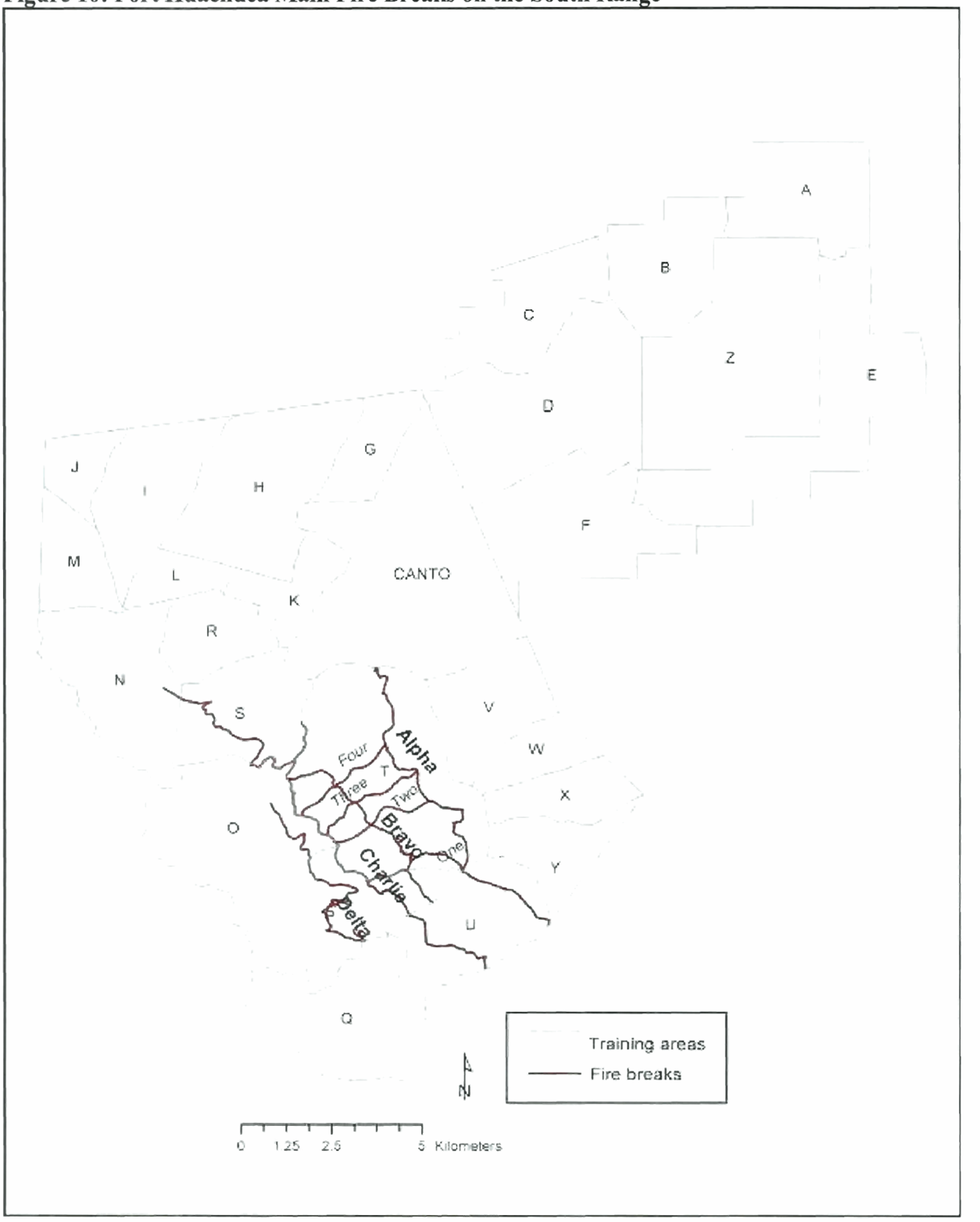
    c. Avoidance of firing activities during high hazard conditions, such as strong winds.

    d. Avoidance of the use of tracers during high to extreme fire danger periods.

    e. Reduction of the potential for adverse effects of fire suppression measures on listed and candidate species and their habitat. A forester or other qualified environmental specialist will be available to serve as a resource advisor to provide guidance to individuals in charge of fire suppression activities.

In addition to the IWFMP, Fort Huachuca plans to implement two fuel reduction projects. These future projects consist of mechanical thinning and prescribed burns in order to reduce ladder fuels. The areas include approximately 100 acres along the Fort Huachuca boundary in training area U and approximately 30 acres along the Fort Huachuca boundary in training area N.

Figure 10: Fort Huachuca Main Fire Breaks on the South Range



Realty Actions and Energy Initiatives

Fort Huachuca has the authority to exchange, acquire, or dispose of lands to benefit their mission. Currently, the Fort has the authority to exchange a 26-acre parcel near Kayetan Drive

and Buffalo Soldier Trail to the Arizona State Land Department for state in-holdings on the East Range. This exchange was authorized by special state legislation in 1987. A related land exchange is pending to gain full title to nine parcels of State of Arizona land on the East Range of the Fort. In cooperation with the Bureau of Land Management (BLM) and the State of Arizona, state trust lands will be exchanged to ensure that full title to those parcels is conveyed to the Federal government. This administrative action will not change land use or activities on those in-holdings.

For numerous years, the City of Sierra Vista has sought to acquire an additional 203 acres from Fort Huachuca adjacent to Libby Army Airfield (LAAF) pursuant to the Airport Improvement Act to be used for aviation-related uses. The City has previously acquired 72 acres under this Act in establishing a civilian municipal airport adjacent to LAAF. In June 2002 the Army set aside further consideration of this transfer to the City of Sierra Vista (Appendix D in the Revised PBA). An alternative to conveyance is currently being considered by the Fort, i.e., a leasing action. If either realty action is proposed in the future it will undergo a separate section 7 consultation.

Fort Huachuca has been a recognized leader in energy and water reduction initiatives over the past dozen years. Water use has been reduced by over 50 percent, or over half a billion gallons per year. The Fort has been below the federal energy conservation goals for the past thirteen years. The Fort has increased the use of renewable energy in the form of solar and wind. Both types of renewables do not consume water in the production of electricity. A 10 Kilowatt wind turbine was installed on the West range in February, 2002. The Army has approved funding for an 850 KW wind turbine in Fiscal Year 2007, and a prototype wind machine of 900 KW is planned for the near future. Also planned in the near future is a solar heating and cooling system for the South Central Plant. With the rising cost of energy, further renewable energy projects are being considered, with the potential for a biomass energy plant and expansion of solar and wind projects.

Currently the Fort is in the process of converting all the remaining indoor water fixtures to low or no water use. Nearly all of approximately 700 urinals have been converted to non water use types. The majority of the showerheads have been converted to have a maximum output of 1.5 gpm. Fort Huachuca has begun to replace toilets with toilets that have a maximum output of 1.6 gpf.

Electrical privatization of the distribution system was accomplished with Sulphur Springs Valley Electric Co-operative in September 2004. The Fort continues to purchase electricity from Tucson Electric Power Company. This privatization will have a positive effect as all the power poles will be brought into not only current safety standards, but also comply with the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) to protect the Bald Eagle and other large predatory birds by installing safety devices to reduce the risk of electrocution.

Privatization of the natural gas distribution system, water production and distribution system, and wastewater collection and treatment system are currently on hold.

Fort Huachuca will execute projects under the Energy Saving Performance Contract that are cost effective and will not only reduce water use but will increase the use of renewable energy and displace the local burning of natural gas for heating and hot water. This will have a significant

positive environmental impact and will improve the air quality for the various species listed in this document.

Programmed Facilities Development

Programmed renovation and construction of facilities development projects support mission-related activities. Army projects programmed for construction within the current cycle are listed in Table 3. Future military construction projects normally occur within the cantonment area and within compatible land use areas. Facilities development projects include MCA project upgrades or improvements to existing buildings.

Cantonment Area

The cantonment area and other developed lands on the Fort cover approximately 5,720 acres, or approximately 8 percent of the installation. The majority of the buildings and structures on the installation are located within the main cantonment area. More than 1,889 buildings are located within the cantonment area. The cantonment area provides the location for a variety of operational and testing facilities, maintenance and production facilities, research, development, test and evaluation, supply facilities, hospital and medical facilities, administrative facilities, housing and community facilities, utility and ground improvements, housing and community support services, as well as administrative and operational directorates and training facilities. Major command headquarters are located throughout the cantonment area as well as maintenance and storage facilities, facilities for research, development and testing, medical care, and training. Within the cantonment and other built-up areas, land management activities and maintenance fall under the direction of the DPW.

Table 3: Long-Range MCA and Operation and Maintenance Army (OMA) Projects Listing (FY-06-LR)

FY	Project Description	Project No.	Scope	Unit of Measure	Funding
06	Effluent Reuse System	84720	--	GA	
06	Repl Family Housing	61718	131	Units	AFHC
06	Whole Neighborhood Revitalization	05984	20	Units	AFHI
06	Renew Military Medical Clinic	66783	--	SF	
07	Repl Family Housing	57119	119	Units	AFHC
07	Whle Nbrhd Revital	62378	16	Units	AFHI
07	850KW Wind Pwr Generation	64925	1,150	SF	ECIP
08	Whole Barracks Cpx Renewal	60085	--	--	MCA
09	Barracks Complex Ph 2	38675	--	--	MCA
09	Bldg Addition Ragatz Hall	54421	--	--	MCA
11	Fire Station Two Company	60550	--	--	MCA
12	Vehicle Maint Fac-EPG	03188	15,000	SF	MCA
13	CHAPEL	50198	5,500	SF	MCA
LR	Replace AFH Miles Manor	58978	86	Units	AFHC
LR	Fam Hse Gen Officer	67261	--	--	AFHC
LR	Replacement Construction	89116	134	Units	AFHC

LR	Privatization	89205	1,756	Units	AFHI
LR	Fam Hsg Improvement	89216	14	Units	AFHI
LR	REHAB BLDG FOR USAICS-BC	31580	61,000	SF	BCA1
LR	CONVERT BLDG 53301-BC	31581	39,500	SF	BCA1
LR	DENTAL CLINIC-BC	32489	28	OU	BCA1
LR	EXCHANGE BRANCH-BC	32548	6,945	SF	BCA1
LR	REHAB BLDG PHASE 2-BC	33261	14,200	SF	BCA1
LR	CONVERT CMET2-BC	33288	41,220	SF	BCA1
LR	UEPH-BC	38785	1	FA	BCA2
LR	Court Room	67266	3,000	SF	BCA5
LR	ECIP BYPASS GAS PIPELINE	43801	--	--	ECIP
LR	850kw Wind Power Generation	64925	--	--	ECIP
LR	CONSOLIDATED MAINT BLDG	01771	--	--	MCA
LR	ELEC MNT/TOE STR	10106	5,500	SF	MCA
LR	Ammunition Supply Point	11708	--	--	MCA
LR	ELECTROMAGNETIC TEST FAC	14601	4,650	SF	MCA
LR	COMMAND OPS& TRN FAC, PH-I	21999	34,000	SF	MCA
LR	Roads Paved	28561	--	--	MCA
LR	TACTIC INTL & MS FAC	38717	7,800	SF	MCA
LR	ELECTRONIC TEST FAC	39158	--	--	MCA
LR	Vehicle Maintenance Shop	47283	--	--	MCA
LR	Test and Evaluation Center	53342	--	--	MCA
LR	Running Track	55128	--	--	MCA
LR	Army Continuing Ed Fac	56208	--	--	MCA
LR	Access Control Bldg East	58603	--	--	MCA
LR	Ctrl Access Bldg-Main Gate	58605	--	--	MCA
LR	Limited Use Instruct Bldg	59671	--	--	MCA
LR	Whole Barracks Renewal	60082	--	--	MCA
LR	Rpl carpet w/tile Barracks	60124	--	--	MCA
LR	Increase Dryer Capacity/BK	60125	--	--	MCA
LR	Rpr HAVC bldg 51005	60126	--	--	MCA
LR	Rpr HAVC bldg 51001	60127	--	--	MCA
LR	Insulate Barracks	60128	--	--	MCA
LR	R/R HVAC locker Rooms	60161	--	--	MCA
LR	Install Sprint Bldg 80505	60166	--	--	MCA
LR	HUMINT Instructional Bldg	60778	--	--	MCA
LR	Intell Combat Trng Bldg	60798	--	--	MCA
LR	Fire Station	60870	--	--	MCA
LR	Post Office, Main	61029	--	--	MCA
LR	Trng Dev Sup	62270	--	--	MCA
LR	UAV Trn Fac	62363	--	--	MCA
LR	Util Sppt Modlr Bldgs	62940	--	--	MCA
LR	Army Global Info Ctr Ph 2	65961	--	--	MCA
LR	Info Processing Center	66372	--	--	MCA
LR	UAV Battalion Headquarters	66441	--	--	MCA
LR	Fire Station Two Co	66548	--	--	MCA

LR	MP Dog Kennels	66926	--	--	MCA
LR	ATC Radar Equip (DAAS)	67471	--	--	MCA
LR	Cantonment Perimtr Fnc	67644	--	--	MCA
LR	Temp Fac Site Prep	67939	--	--	MCA
LR	Community Club Expansion	36625	--	--	NACAF
LR	COMMUNITY RECREATION COMPL	45970	15,000	SF	NACAF
LR	BOWLING CENTER	43410	--	--	NAMWF
LR	SPORTSMAN CENTER	45969	10,000	SF	NAMWF
LR	BUFFALO CORRAL UPGRADE	45972	--	--	NAMWF
LR	RV PARK EXPANSION	53018	3,500	SF	NAMWF
LR	Army Community Serv Ctr	60395	40,000	SF	NAMWF
LR	TEST & EVAL FACILITY	50945	--	--	UMMCA

Fort Huachuca maintains and operates a number of facilities and conducts activities associated with operating a military installation. These include: (1) operation and maintenance of a 3.1 million gallon (mg) per day capacity wastewater treatment plant; (2) collection of solid waste, and disposal primarily at the Huachuca City landfill, but some material goes to the Elfrida landfill; (3) a network of roads, most of which are primary or collector streets in the cantonment area, and many unpaved routes on the training ranges; (4) operation of three gates to the installation: the Main, East, and West Gates; (5) distribution and use of electricity supplied by Tucson Electric Power Company (Fort Huachuca used 112,910,400 kilowatt-hours in Fiscal Year 2005); (6) distribution and use of stationary fuels, such as natural gas furnished by Southwest Gas Company and propane; and (7) distribution, storage and use of vehicle and aircraft fuels.

The following outdoor training facilities are located within the cantonment area:

- Obstacle Course - Clover shaped with 17 obstacles. This course is a test of a soldier's basic motor skills and physical conditioning.

- Confidence Course - Clover shaped with four groups of higher and more difficult obstacles than the obstacle course. Designed to give soldiers confidence in their mental and physical abilities and cultivate their spirit of daring; and

- LAAF is located in the northernmost corner of the cantonment area. This airfield consists of a 12,000 foot Class "B" main runway on an east-west axis, a 5,365 foot secondary runway on a southeast-northwest axis, and a 4,300 foot tertiary runway running parallel to the main runway. Support facilities including a flight control tower, a navigational aids building, an airfield operations building, an airfield fire and rescue station, and storage buildings are located along the southern side of the main runway and within the operational land use zone. Maintenance facilities and the City of Sierra Vista air terminal are on the north side of the airfield (Zillgens 1991).

Training Area Activities

The Revised PBA contains a list of each of the training areas (Alpha through Zulu) on the installation and the activities conducted in the respective areas; this information is incorporated

herein via reference. Information sources for this section of the Revised PBA included interviews with the Range Control Officer, ATC and Air Operations Personnel, annual range utilization surveys, and a supplemental study on training area utilization (SAIC 1997b). Table 4 provides a listing of individual training areas and the type of traffic (both on-road and off-road) permitted in each area.

Table 4: Terrain Type and Traffic Permitted by Training Area

Training Area	Location by Range	Total Acres	Terrain Type	Traffic Permitted On Existing Road and Trails	Traffic Permitted Off Existing Roads and Trails
Alpha	East	2471	High Desert	Foot/Wheel	Foot
Bravo	East	2471	High Desert	Foot/Wheel/Tracked	Foot/Wheel
Charlie	East	2100	High Desert	Foot/Wheel/Tracked	Foot/Wheel/Tracked [1]
Delta	East	4694	High Desert	Foot/Wheel/Tracked	Foot/Wheel/Tracked [1]
Echo	East	4942	High Desert	Foot/Wheel	Foot
Foxtrot	East	3583	High Desert	Foot/Wheel/Tracked	Foot
Golf	West	1087	High Desert	Foot/Wheel	Foot
Hotel	West	4200	High Desert	Foot/Wheel	Foot
India	West	2223	High Desert	Foot/Wheel	Foot
Juliet	West	1111	High Desert	Foot/Wheel	Foot
Kilo	West	1136	High Desert	Foot/Wheel	Foot
Lima	West	840	High Desert	Foot/Wheel	Foot
Mike	West	1087	High Desert	Foot/Wheel	Foot
November	West	3410	Mountain	Foot/Wheel	Foot
Oscar	South	2619	Mountain	Foot/Wheel	Foot
Papa	South	3459	Mountain	Foot/Wheel	Foot
Quebec	South	2347	Mountain	Foot/Wheel	Foot
Romeo	West	1359	Mountain	Foot/Wheel	Foot
Sierra	South	2322	Mountain	Foot/Wheel	Foot
Tango	South	5312	Mountain	Foot/Wheel	Foot
Uniform	South	2347	Mountain	Foot/Wheel	Foot
Victor	South	1599	High Desert	Foot/Wheel	Foot
Whiskey	South	1482	High Desert	Foot/Wheel	Foot
X-Ray	South	1235	High Desert	Foot/Wheel	Foot
Yankee	South	1482	High Desert	Foot/Wheel	Foot
Zulu	East	6954	High Desert	Foot/Wheel	Foot

[1] Off-road wheeled and tracked-vehicle traffic is restricted to existing off-road maneuvering lanes. These lanes are currently inactive and have no programmed use. Any such future use of these lanes is subject to NEPA documentation and FWS consultation prior to any scheduled use. As of this time, there is no authorized off-road activity in these lanes.

Off-Post Activities Authorized or Carried Out by Fort Huachuca

For military training purposes the Fort leases approximately 948 acres from a variety of land owners, primarily in southeastern Arizona (Appendix E of the Revised PBA). An additional 27,387 acres on the Willcox Playa, Cochise County, is withdrawn from public entry. Parcels leased vary in size from less than an acre to 640 acres on Oatman Mountain. Although most leased/withdrawn land is in Cochise County, the Fort also leases land near Phoenix, Gila Bend, Oatman Mountain, Mount Graham, and Mount Lemmon, Arizona; and Lordsburg, New Mexico. Many are ASA or communications sites (antennas, microwave towers, etc.). Others are pull-off sites along roadways where equipment is temporarily operated. Uses of each site are described in Appendix E of the Revised PBA. Much of the equipment is temporarily operated. Many of the equipment tests and field training exercises conducted by a variety of training units at Fort Huachuca require placement of equipment over a large geographic area.

Future Population Fluctuations and Activities

The proposed action has been structured to allow Fort Huachuca to accomplish its mission over the 10-year course of action described in the Revised PBA. Historically Fort Huachuca's population has fluctuated by up to 3,000 personnel to meet mission requirements. This normal population fluctuation will continue as the Fort responds to Department of the Army and national defense requirements around the world in the war on terror. The number of people Fort Huachuca employs is currently approximately 13,000 personnel and could go up to 16,000 personnel to meet the nation's and Department of Army requirements. Note that these numbers do not represent the total population attributable to the Fort. Therefore this population range and fluctuation is made a part of the proposed action. The Fort does not know whether this will occur but it requires this latitude to respond to a wide divergence in numbers of students to be trained each year, deployments, temporary mission spikes, etc. Currently potential changes include a decrease to the 11th Signal Brigade (assignment of communication personnel/equipment to the troop units) and increases in contractor personnel (intelligence training and electronic testing). Figure 12 in the Revised PBA illustrates that water usage at the Fort has declined despite an increase of 3,000 personnel between 1995 to present (Figure 13 in the Revised PBA). Fort Huachuca can therefore accommodate additional growth, if necessary, accomplish the mission and continue to meet its water conservation measures. Any water usage associated with potential additional personnel will be reflected and captured using the Fort's per capita water usage approach. In addition, students are temporarily assigned at the Fort and many of the other Fort jobs are filled by people already here in the community and already associated with the Fort. The Fort will continue to enforce its water mitigation policy and seek additional opportunities for mitigation through the Upper San Pedro Partnership (USPP) to reduce water usage associated with potential additional personnel in the future.

FIGURE 11: GROUNDWATER PUMPING

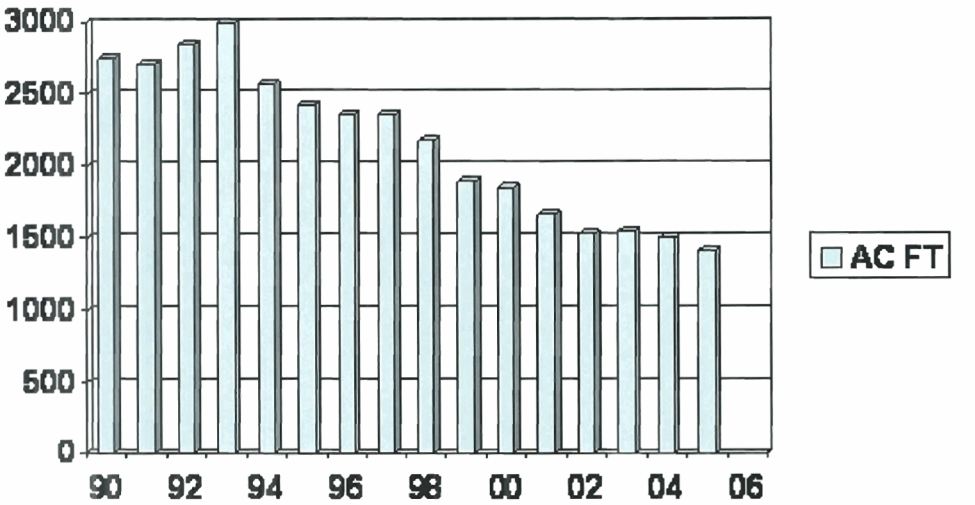
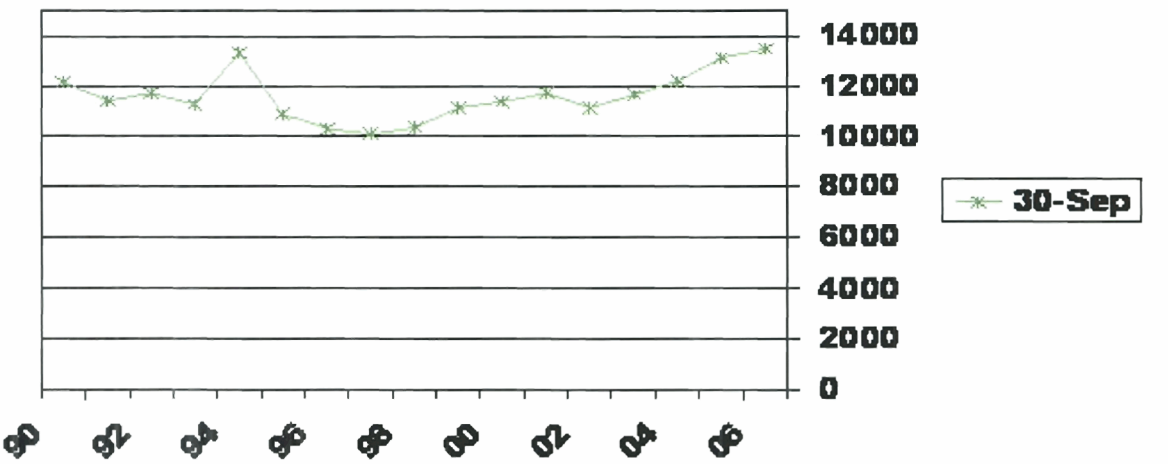


FIGURE 12 POST POPULATION



Description of the Proposed Conservation Measures

Water-Related Conservation Measures

Fort Huachuca has worked over the past decade to reduce ground water consumption rates in the Sierra Vista Subwatershed, primarily through reductions in ground water demand both on-post and off-post and increased artificial and enhanced recharge of the ground water system. Annual pumping from Fort Huachuca production wells, as shown in Figure 34 of the Revised PBA, has decreased from a high of approximately 3,200 AF in 1989 to a low of approximately 1,400 AF in 2005. Since 1993, ground water pumping has generally declined, despite a multi-year drought beginning in approximately 1999. Water use efficiency in the City of Sierra Vista as measured by per capita water use (gallons per capita per day; GPCD) has improved from 191 GPCD in 2000 to 156 GPCD in 2005 resulting in a slight decrease in pumping (roughly 2 percent).

Agricultural pumping, while not expressed in per-capita terms, has decreased by approximately 50 percent from 5,000 AFA in 1985 to 2500 AFA in 2002 (ADWR 2005).

In the case of Fort Huachuca, the reduction in water demand has occurred through a variety of measures including fixture upgrades (i.e., replacement of high water use plumbing fixtures with low water use fixtures), facility infrastructure removal/consolidation (i.e., demolition of facilities), aggressive leak detection and repair, water conservation education, and implementation of a strict landscape watering policy in military family housing (MFH). Agricultural pumping has decreased as a result of the retirement of agriculture associated with creation of the San Pedro RNCA and through the purchase of conservation easements by Fort Huachuca in partnership with The Nature Conservancy (TNC).

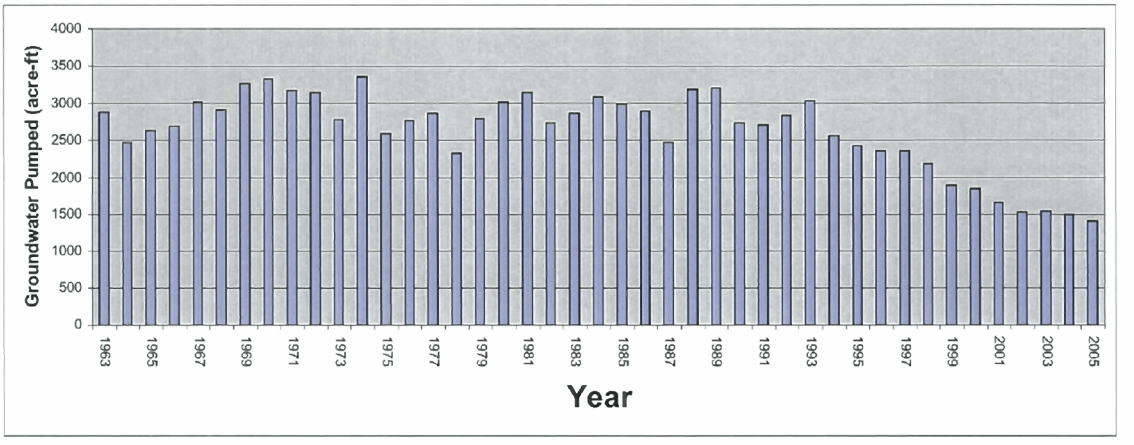
In the past five years, Fort Huachuca and the City of Sierra Vista have increased the amount of water recharged to the regional aquifer through construction of effluent recharge facilities and detention basins that not only increase storm water recharge but mitigate the negative effects of increased runoff from urbanization. The amount of effluent that was recharged by Fort Huachuca and the City of Sierra Vista in 2005 was 426 AF and 1,868 AF, respectively. During this same year, enhanced storm water recharge at detention basins was estimated to be 129 AF.

The total net effect of all the combined efforts initiated just by Fort Huachuca has been to reduce the net ground water consumption by approximately 2,272 AFA (71 percent) since 1989. The impact of this and other net reductions in ground water consumption on the regional ground water deficit is discussed in detail in the subsections following this narrative.

This section provides an overview of ongoing and planned efforts to further reduce the regional ground water deficit. Simply reducing the regional ground water deficit, however, does not insure the health of the San Pedro River and the endangered species dependent on this resource, notably the Huachuca water umbel, since it ignores the spatial and temporal aspects of pumping. Therefore, this section will also address a planned effort to analyze the spatial and temporal aspects of pumping and recharge on the ground and surface water system in order to develop a long-term science-based mitigation strategy that will more effectively protect and enhance existing populations of Huachuca water umbel and designated critical habitat.

Many of the planned projects/strategies to reduce the deficit are at various stages of implementation (i.e., currently under design or construction). However, some of the planned projects/strategies are conceptual in nature only and may be altered, replaced, or abandoned as understanding of the San Pedro River riparian ecosystem and the regional ground water system upon which it depends improves. This adaptive management approach takes advantage of the expanding body of knowledge regarding spatial and temporal aspects of ground water pumping on the regional ground water system and San Pedro River.

Revised PBA Figure 34: Historic Ground Water Pumping at Fort Huachuca from the Period 1963 to 2005



Waterwise and Energy Smart Program (WWES)

The WWES program at Fort Huachuca is operated under contract with the University of Arizona Cooperative Extension program. The purpose of the contract is to provide water and energy conservation education and related support services to the U.S. Army, contractor employees, and family members who either work or live on Fort Huachuca, Arizona. Water conservation support is described as any activity that relates to education on water use reduction, provision of literature or related water conservation products, submission of service orders for repair of water leaks, audits or inspections of how water is used, recommendations on reductions in use, and assistance in the planning or execution of landscape renovation projects. Though it is difficult to quantify the effects of water conservation education on reduced ground water demand, the WWES program deserves partial credit for the significant reductions in ground water pumping that have occurred at Fort Huachuca. One aspect of the WWES program, however, is a directly quantifiable contribution. Since January 2004, WWES has been conducting water conservation audits of facilities on post. Thus far, these audits have resulted in water savings exceeding two (2) AFA.

Military Family Housing - Whole Neighborhood Revitalization Projects

Since 1995, Fort Huachuca has been upgrading military family housing (MFH) post-wide as part of a multi-year whole neighborhood revitalization effort expected to be complete in 2011. This effort involves the demolition and replacement of existing housing units and neighborhood infrastructure (roads and utilities). The total number of occupied dwellings in 2001 was 1,794. Upon completion of the revitalization effort, there will be approximately 1425 housing units. Housing units that have been and will be replaced were constructed prior to the adoption of local, state, and Federal standards/codes that limit flow rates in various plumbing fixtures. Water use fixtures in new homes will meet or exceed current building codes related to water use efficiency. In addition, all new homes will be equipped with air conditioning vs. evaporative cooling. The overall footprint of turf at new homes is being reduced from an estimated 3,000 square feet per home to approximately 1,800 square feet or less per home. Savings associated with turf reduction in MFH are addressed in the Landscape Irrigation section, below.

Replacement of Industrial/Commercial Water Fixtures

The replacement of high water use fixtures with low or no water use fixtures has produced substantial water savings. Beginning in the late 1990s, Fort Huachuca began replacing flush urinals with waterless urinals. Fort Huachuca plans to replace all its flush urinals with waterless urinals by the end of 2007 for a total estimated water savings of 66 AFA. Fort Huachuca also began installing 170 pressure assist toilets in 95 MFH housing units. Water savings associated with toilet replacement are estimated to be 0.74 AFA.

Fort Huachuca replaced top loading washers with horizontal axis washers at its military barracks laundry facilities resulting in water savings of approximately 17 AFA. Additional water savings of 0.3 AFA will be achieved by washer replacement at the AAFES laundry facility projected to occur in 2008.

Reducing Consumptive Water Use

Consumptive use of water accounts for almost 50 percent of total water use at Fort Huachuca as estimated by comparing the total amount of ground water pumped to sewer return flows. Since any reduction in consumptive water use essentially offsets ground water pumping on a one-to-one basis (i.e., each gallon reduction in consumptive water use decreases pumping by one gallon), water savings in this category are the most effective at reducing water demand.

A Colorado State University website (http://waterknowledge.colostate.edu/) defines consumptive use of water as "that part of water withdrawn that is evaporated, transpired, incorporated into products or crops, consumed by humans or livestock, or otherwise removed from the immediate water environment." In this report, consumptive water use is more narrowly defined as that portion of water pumped from the ground water system that does not return to the wastewater treatment plant. Based on this more narrow definition, consumptive water use can include the following:

- Landscape Irrigation
- Vehicle Washing
- Firefighting Activities
- Fire Hydrant Testing
- Construction-Related Water Use including dust control, soil moisture adjustment and testing/flushing of newly constructed water lines
- Facility Climate Control including evaporative cooling and cooling tower water use
- Potable Water Distribution System Testing/Flushing
- Potable Water Distribution System Leaks
- Swimming Pool Consumptive Water Use including evaporation and leaks

- Sewer conveyance losses including sewer system leaks and sewage disposal through septic systems

Fort Huachuca has already taken a number of steps to reduce consumptive water use and proposes to take additional steps to further reduce this water demand. This section addresses these efforts.

Fort Huachuca Irrigation and Water Management Policy
In May 2005, Fort Huachuca updated its irrigation and water management policy. This policy places restrictions on irrigation of turf in MFH. It also specifies procedures for activities that use water insuring that water use efficiency is maximized. This policy also places restrictions and/or limits on outdoor decorative water features, new turf installation, and water use fixtures. As is the case with Fort Huachuca's water conservation education efforts, the impact of this policy cannot be readily quantified; however, it deserves partial credit for the significant reductions in ground water pumping that have occurred at Fort Huachuca.

Infrastructure Repair/Replacement/O&M
In 1997, a water leak detection survey of Fort Huachuca's potable water distribution system was performed by WaterNet Survey. The survey identified a total of 68 leaks with an estimated loss of approximately 325 AFA, although 60 percent of the estimated loss could be accounted for by two of the leaks. The leaks were placed into three priority classes. Priority class 1 leaks were those leaks deemed severe in nature where losses typically exceeded 5 gallons per minute (GPM). Priority 2 leaks were those where losses were typically 5 GPM or less and repairs could be readily accomplished. Priority 3 leaks were typically 1 GPM or less and the repairs would be costly. To date, all category 1 and 2 repairs have been completed resulting in an estimated savings of 278 AFA.

As previously mentioned, MFH whole neighborhood revitalization projects include the demolition and replacement of existing infrastructure including sanitary sewer and potable water distribution systems. The replacement of this infrastructure will have a positive, non-quantified impact on system losses (from both potable water distribution systems and sewer conveyance systems that return non-consumptively used water to the wastewater treatment plant).

In 2006, repairs were made to the water level control system at the Barnes Field House (BFH) pool. Previously, water that discharged to the pool gutter system was not recirculated. Technically, this water loss was not a consumptive use of water since the water was discharged to the sanitary sewer. However, it resulted in the frequent addition of fresh water to maintain the pool water level. The water level control system now recirculates pool water to maintain an adequate water level without the almost continuous addition of fresh water. Estimated water savings from this repair is 46 AFA.

In 2005, Grierson Pool was permanently closed. This pool had been determined to be leaking. Closing of the pool has not only eliminated water losses from leaking but also has eliminated water losses from evaporation and pool maintenance activities. The total estimated water savings from just the elimination of evaporative losses is 1.4 AFA.

Several operations and maintenance (O&M) practices at Fort Huachuca which currently result in the consumptive use of ground water could be modified to allow capture of this water in the

sanitary sewer system. These practices include fire hydrant testing and flushing of potable water system components during maintenance/repair activities in which water is currently directed to streets/gutters. Fort Huachuca proposes to capture this water in the sanitary sewer thereby increasing the quantity of treated effluent available for recharge by approximately 32 AFA.

Booster pumps associated with ground water production wells are currently sealed with packing glands that must be cooled by a continuous flow of water at a rate of approximately one gallon per minute. Fort Huachuca will replace pump packing glands with mechanical seals that do not require cooling water for an estimated water savings of 12.9 AFA.

Facility Climate Control
There are 186 non-MFH buildings on Fort Huachuca that are currently being cooled by evaporative cooling units. The total number of evaporative coolers is 575 and the estimated water demand is 44 AFA.

Of the 186 buildings evaporatively cooled, 103 buildings (299 evaporative coolers) are being evaluated for conversion to air conditioning for an estimated water savings of 23 AFA whereas 11 buildings are planned for demolition with replacement buildings to be air conditioned for an estimated 2.5 AFA in water savings.

Landscape Irrigation
In 1994, a watering policy was put first into place that reduced by roughly half the amount of time that watering that could be done in MFH. This policy had a substantial impact on total ground water use by Fort Huachuca resulting in an approximately 15 percent reduction in ground water pumping between 1993 and 1994. Since this time, this policy has been updated and expanded to encompass a variety of water conservation and waste minimization strategies as previously discussed.

Beginning with the FY02 whole neighborhood revitalization project (Pershing Plaza West Phase I), the footprint of turf at each house has been substantially reduced. The 65 homes constructed as part of Pershing Plaza West Phase I each have 1,500 square feet (ft^2) of turf for a total predicted supplemental water demand of approximately 3 AFA. There is no turf in common areas. Current and future housing projects will incorporate approximately 1800 ft^2 of turf, which is substantially less than the estimated 3,000 ft^2 of turf per home in housing areas revitalized prior to FY02. In addition, turf in select common areas is being replaced with xeriscaping. Total MFH turf supplemental water demand is predicted to be approximately 100 AFA at a total build out of 1,425 housing units. This represents an 18 percent decrease from the projected 2001 MFH turf demand of 122 AFA.

There are approximately 37 acres of turf currently under irrigation with ground water at recreational/common areas throughout Fort Huachuca. Several sports fields maintain turf year round. Current supplemental water demand is estimated to be 127 AFA. In 2005, Fort Huachuca replaced approximately 95,374 square feet of natural turf (Bermuda grass) with artificial turf at Sentinel Field. This area had previously been irrigated with reclaimed water with a total predicted supplemental water demand of 5.7 AFA. Fort Huachuca is planning to replace another 66,000 square feet of natural turf with artificial turf at Warrior Field. Although the turf being replaced is currently not irrigated, this additional playing surface will facilitate the closure of three athletic fields (Brock, Pauly, and Smiley) with an estimated supplemental water demand of 18.6 AFA.

Automatic drip irrigation systems exist at some facilities on post. These systems are capable of supplying water to various landscaped areas. A survey of existing irrigation systems at Fort Huachuca conducted by the Waterwise Program in 2005 indicated that most systems are not functioning. Water is generally not being applied to landscaped or turfed areas where manual watering is necessary. This has resulted in the die-off of plants not adapted to the semi-arid conditions of southeastern Arizona; a situation exacerbated by the exceptionally dry conditions of the past several years. In many cases, plants that do not survive will not be replaced resulting in an overall decrease in plant density. When plants are replaced, they will be selected from Fort Huachuca's revised list of acceptable plants for landscaping. The revised plant list includes only native vegetation and plant species adapted to arid conditions and has been incorporated into the Installation Design Guide (IDG) currently under revision. The IDG also encourages the use of passive rainwater capture for landscape irrigation through means of swales, berms, and catchment basins that direct rainwater from rooftop drainage systems to landscaped areas.

Vehicle Washing Activities

Fort Huachuca's Irrigation and Water Management policy identifies procedures for car washing, such as the use of nozzles to control water flow, that are intended to conserve water. AAFES is considering the installation of a self-serve carwash at the Main Gate Shopette that will recycle 80 percent of the wash water. Non-recycling self serve systems use an estimated 15 gallons per vehicle. There has been discussion about restricting car washing activities to the self-serve station when/if it is built. Net water use per vehicle wash would be 3 gallons vs. the estimated 150 gallons per wash for the typical hose and bucket method of washing. Even if on-post car washing increased approximately five-fold from the total estimated 20,112 washes per year to 100,000 washes per year, net car washing water demand would still be reduced by more than 8 AFA.

The washing of privately-owned vehicles (POVs) in MFH areas has been estimated to use 8 AFA of potable water based on one car wash per household (1495 occupied households in 2004) per month at 150 gallons per wash for a total of 17,940 washes (Clarke, *et. al.*, 1988).

Management of Stormwater to Enhance Recharge

Urbanization has the unintended effect of increasing runoff that discharges to stream channels. Once this runoff has entered a stream channel, it is more likely to recharge the ground water system since stream channels tend be underlain by less impervious sediments than adjacent upland areas. By manipulating stream channels to detain a portion of the runoff through such means as detention basins, storm water recharge can be further enhanced. This enhancement occurs by increasing the length of time that the channel remains wetted while having the side benefits of decreased erosion and increased downstream flood protection. Fort Huachuca's Graveyard Gulch detention basin was built entirely for the dual purposes of enhancing recharge and reducing erosion. This facility detains storm water runoff from an urbanized watershed within the City of Sierra Vista. Appendix H in the Revised PBA summarizes additional detention basins Fort Huachuca is planning to construct or enlarge for an estimated 639 AFA of enhanced storm water recharge. These facilities are either being built or altered entirely for the purpose of enhanced recharge and erosion control.

In addition to the construction of detention basins for enhanced recharge/erosion control, Fort Huachuca is implementing storm water management standards through its Installation Design

Guide (IDG) currently under revision. Section 7.2 of the IDG, Site Planning Objectives, includes the integration of passive rainwater harvesting techniques in site design to at least partially meet landscape irrigation requirements and to prevent excessive runoff that could lead to decreased downstream water quality.

This document will also require the more widespread use of dry wells to facilitate site drainage and increase storm water recharge. To this end, the USPP has approved the allocation of funds to design dry well systems at three facilities on Fort Huachuca to direct rooftop runoff to the subsurface. This project is being implemented as a pilot project to evaluate the more widespread use of drywells to enhance storm water recharge on site. The quantity of rainwater Fort Huachuca expects to recharge through the pilot rooftop rainwater capture/drywell discharge systems is two AFA.

Effluent Recharge

In 2001, Fort Huachuca began diverting treated effluent to its newly constructed East Range Recharge Facility. This facility consists of a series of shallow spreading basins designed for rapid infiltration of treated effluent. The total recharge capacity of the facility is approximately 1,000 AFA. The actual recharge that occurs on an annual basis is a function of effluent generated at the wastewater treatment facility minus reclaimed water demand (estimated at approximately 300 AFA). Somewhat ironically, conservation efforts at Fort Huachuca have led to decreased effluent recharge since the facility was opened in 2001. The actual recharge that would eventually occur based on a 2005 baseline of implementation was approximately 426 AF, which accounts for a 2.5 percent evaporative loss. By 2016, the eventual recharge of Fort Huachuca effluent is predicted to be 489 AFA.

Fort Huachuca has submitted a project for funding in fiscal year 2008 that will recharge up to 400 AFA of treated effluent to be generated by Huachuca City. The recharge facility will be constructed on Fort Huachuca property but the actual location will be assessed based on ability to provide spatially-based mitigation as discussed in section entitled Waterwise and Energy Smart Program, above.

Conservation Easements

Fort Huachuca acquires real property easements as a conservation measure, and is currently pursuing the purchase of two conservation easements on a tract of land north of the Fort's East Range boundary. To date, Fort Huachuca has purchased conservation easements resulting in the retirement of 1,073 AFA

Fort Huachuca has also entered into a cooperative agreement with TNC under the Army Compatible Use Buffer (ACUB) program for establishment of conservation easements within the Sierra Vista Subwatershed. Other cooperating partners for this program include the FWS, BLM and the USPP who are all actively working on water use, endangered species management and open space issues within the Sierra Vista Subwatershed. The ACUB program will assist the Fort in implementing the Sikes Act, endangered species management and recovery programs on the Fort and within the San Pedro RNCA and the Sierra Vista Subwatershed. One objective of conservation easements under the ACUB program will be to support the Fort's military mission by reducing encroachment along the Fort's perimeter boundary. In doing this, the Army proposes funding the purchase of conservation easements that will limit future land development thus

keeping rural lands in their current undeveloped state. This action will protect parts of the Babocomari River and other tributaries to the San Pedro River from being impacted because of urban development and prevent alteration of habitat that supports endangered species. Through the ACUB conservation easement program, wildlife movement corridors from both the San Pedro and Babocomari rivers to the Huachuca, Whetstone and Mustang Hills mountains will be maintained in their current open-space conditions. Another objective of conservation easements will be to retire current land uses that result in high water use, such as crop irrigation, or reduce future water uses for residential development.

The process to establish a conservation easement typically begins with TNC purchasing property from a willing seller for fair market value. This property will normally include irrigation rights or address previous irrigated agriculture activity on the property. Deed restrictions are added to the property to reflect the conservation easement and the TNC resells the property to a private individual or entity. An alternative method of establishing a conservation easement is to purchase the easement from the existing landowner, and add permanent deed restrictions to the property, with the landowner maintaining possession of the property.

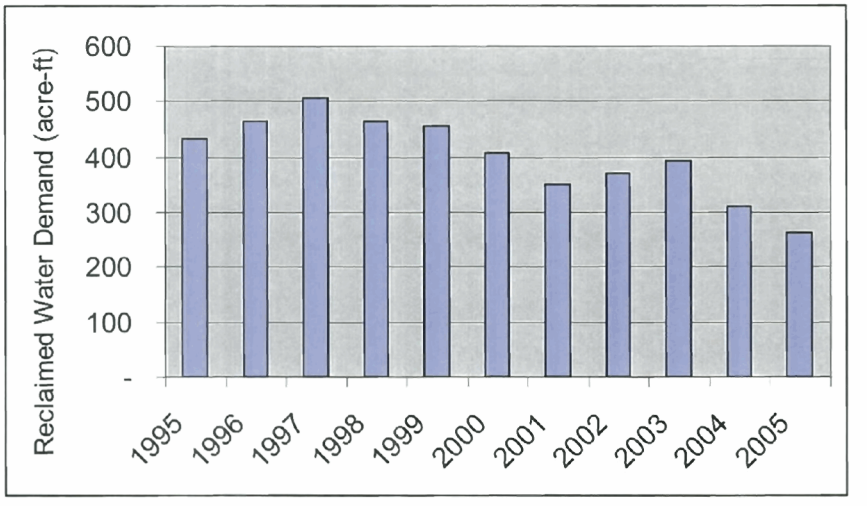
Based on previous pumping records or anticipated future water use, Fort Huachuca and the FWS will determine the appropriate water savings credit that will accrue to the Army upon purchase of the conservation easement. The "credit" is then used to offset potential impacts to critical habitat and threatened/endangered species due to ground water use attributable to the Fort – whether on- or off post. The conservation easement usually includes restrictions against irrigation for agricultural purposes on the property, or limits the landowner's ability to subdivide the property. Property remains on the tax rolls, and may be used for residential, commercial or agricultural land uses consistent with the terms of the conservation easement.

Fort Huachuca will continue to work with the TNC, BLM, FWS, and any other willing partners to aggressively search for conservation easement opportunities.

Reclaimed Water Use

Current reclaimed water demand at Fort Huachuca is estimated to be approximately 300 AFA. Historic actual reclaimed water demand at the Mountain View Golf Course (MVGC), the predominant user of reclaimed water at Fort Huachuca, is shown in Figure 35 of the Revised PBA, reproduced below.

Revised PBA Figure 35: Historic Reclaimed Water Demand at MVGC



Reclaimed water demand at MVGC has steadily declined since 2003 despite an ongoing drought. In 2004, MVGC converted to a desert-type course layout by reducing the amount of fairway under irrigation. In spring of 2005, a new irrigation system for MVGC was completed that, among other things, eliminated sprinkler heads in areas converted to desertscape. An additional modification to the irrigation system is currently under design that will improve the ability to independently irrigate separate portions of the golf course. Upon implementation of all improvements, the targeted annual reclaimed water demand at MVGC is 250 AFA. The reclaimed water saved by irrigation efficiency improvements at MVGC will be used for sports fields currently irrigated with ground water or will be recharged at the East Range Recharge Facility.

Water Mitigation Policy

Fort Huachuca has established a water mitigation policy that will identify mission growth and assist in reducing Fort Huachuca's net water consumption in the Sierra Vista Subwatershed. The Fort's mitigation policy requires new activities to fund projects or portions of projects that offset any increased water use associated with their proposed actions. This policy allows Fort Huachuca to track mission growth and to achieve the water saving goals outlined in the conservation measures described above.

As reflected in the September 30, 2005, Post Population Report, Fort Huachuca currently employs 13,098 people on post (number that does not represent the total population attributable to the installation). This includes permanent party military, government civilians, contractors and other support personnel, and military students who are here on a temporary duty basis. Following the September 11, 2001 terrorist attacks on the Pentagon and the World Trade Center, America's national defense needs have fundamentally and irreversibly changed. The Army is rapidly transforming to protect our citizens and nation's interests throughout the world, to include fighting the war against terrorism. This new world reality will undoubtedly impact Fort Huachuca's operations, particularly its military intelligence and communications security missions. As a result, Fort Huachuca anticipates that it may be called upon to support additional wartime mission requirements to meet national defense needs. Fort Huachuca will balance the

need to support additional mission requirements and continue to address ground water issues through its water mitigation policy (Appendix L in the Revised PBA).

The Fort's mitigation policy is an important conservation measure and funding mechanism because it requires all tenants, agencies, and activities to mitigate water use associated with their proposed actions and supports allocating funding to do so. The following important components of this conservation measure are quoted from the policy:

1. To comply with the ACT, and allow for mission requirements, any organization increasing its overall personnel strength in the Fort Huachuca area must mitigate the water use associated with these additional personnel and their family members. This mitigation policy also applies to contract employees who work on the installation.

2. Each employee authorization adds direct and indirect effects, as well as the effects of interdependent and interrelated actions for themselves, their families, and within the community. Mitigation will be assessed based on increases from the organization's personnel baseline on 30 September 2005, as reflected in the installation post population report (Appendix G in the Revised PBA).

3. Mitigation for large increases in personnel (over 30 personnel associated with a single project or action), to include civilian contractors who work on post, will occur prior to the personnel increase or hiring action. Otherwise the mitigation fee will be paid by the organization with personnel growth when the annual 30 September post population report is issued. Mitigation may be accomplished by the gaining organization in at least two ways. Either method must be coordinated through the Environmental and Natural Resources Division (ENRD).

    a. The first mitigation method is on-site. For organizations with large facilities, conservation technology may be installed in their facilities if it will completely mitigate the increased water use of the additional personnel. However, this will be done at the gaining organization's expense.

    b. If the organization increases personnel and cannot reduce water use at their facilities sufficiently on their own, the second method of mitigation requires working with the DPW. Cost for this mitigation method is $1,500 per additional employee. This money will be paid to the DPW and is a one-time fee per position added. The fee applies to all personnel increases, regardless of where the employee or contractor worked or was located prior to the hiring action. The mitigation fee is not an augmentation to the Garrison's appropriated funds budget because it pays to mitigate water consumption resulting from personnel increases that have not been otherwise funded by Department of the Army (DA) in the Garrison's annual budget.

Funds generated from requesting activities will be used to fund specific conservation measures. Principally, these will be water conservation technology, conservation easements, and storm water recharge. Activity funds will be obligated toward conservation measures within 12 months after receiving funding.

Regional Efforts through the Upper San Pedro Partnership

The USPP was formed in 1998 to implement sound water resource management and conservation strategies for the intended purpose of preserving the San Pedro Riparian National Conservation Area (San Pedro RNCA) and to ensure the long-term viability of Fort Huachuca. It is a consortium of 21 agencies and organizations, public and private, that own and/or control land or water use in the Sierra Vista Subwatershed of the Upper San Pedro River Basin. Member agencies sign a Memorandum of Understanding that commits them "to coordinate and cooperate in the identification, prioritization and implementation of comprehensive policies and projects to assist in meeting water needs in the Sierra Vista Sub watershed" and to identify funding for projects that address this goal.

Structure

The work of the USPP is conducted through its committees. Activities are coordinated by an Executive Director and reported to the USPP's committee of the whole, called the Partnership Advisory Commission (PAC), which meets monthly. The PAC is analogous to a corporate board of directors insofar as it establishes the strategic direction and provides leadership to achieve the goals of the USPP. Specifically, PAC approves changes to the organization structure, ensures elected officials at all levels understand what resources are needed to implement the USPP's water management and conservation activities, reviews projects and programs for their effectiveness, and reviews strategies by member agencies relative to water issues and activities. Fort Huachuca's Garrison Commander represents the installation on the PAC. Fort Huachuca ENRD staffers are members of the Technical Committee.

Planning Goals – Reporting

In 2001, the USPP published the first in a series of Water Conservation Plans summarizing projects and activities in support of its goals to "save the river, save the Fort." These Water Conservation Plans were published between 2001 and 2005. They laid the groundwork for the USPP's three-pronged approach to meet the water needs of the San Pedro River and the Sierra Vista Subwatershed.

1. Research: Improve understanding of the hydrology in the San Pedro Riparian National Conservation Area (San Pedro RNCA) and regional aquifer.

2. Planning: Undertake feasibility studies to reduce ground water pumping (e.g., treated effluent to golf courses) and to augment water supplies (e.g., harvesting of storm water runoff).

3. Projects: Participate as a funding partner and/or project manager in so called "wet-water" projects to reduce ground water pumping and/or reuse effluent.

Education and water conservation incentives complement these programs to lower water demand by residents and local businesses.

In 2004, the Defense Authorization Act, Public Law 108-136, Section 321, stipulated the way in which section 7 of the Endangered Species Act applies to Fort Huachuca. It required the USPP to document "water use management and conservation measures that have been implemented and are needed to restore and maintain the sustainable yield of the regional aquifer by and after September 30, 2011." These reports are required to be submitted to Congress annually from 2004 to 2011. The so called "321 Report" has taken the place of the USPP's Water Conservation Plans as its documentation of activities, progress to goals, and quantified yields. To date, the

2004 321 Report has been sent to Congress. The 2005 Report is awaiting signature of the Secretary of the Department of Interior. The 2006 Report has been written and is being reviewed by U.S. Geological Survey prior to being sent to OMB. Work on the 2007 report has started.

In 2006, the USPP approved its first long-range plan as part of a larger effort to accelerate progress to goals. It covers the period 2006 through 2011 and identifies seven goals. The first three goals drive the action steps in the rest of the plan.

1. Minimize ground water use throughout the sub-watershed to restore and maintain adequate ground water elevations at key locations by 2011.

2. Maximize recharge and reuse of water to restore and maintain adequate ground water elevations at key locations by 2011.

3. Augment area water supplies as necessary to restore and maintain adequate ground water elevations at key locations by 2011.

4. Overcome legal impediments and fill legislative gaps which inhibit achievement of this plan's purpose by October 1, 2009.

5. Ensure all necessary funding to carry out the water management objectives of the USPP.

6. Verify, monitor and report on USPP and member agency progress toward achieving this plan's purpose using best available science.

7. Ensure continuous and consistent long-range planning and project implementation through an adaptive management context.

The Executive Committee ensures the USPP's human and financial resources are focused on these goals.

Projects
USPP projects and initiatives fall under the categories of its three-pronged approach described above. Research, project development activities, and water mitigation-related projects are summarized below.

Table 5: Research, Education, and Reporting

	RESPONSIBLE AGENCY	VALUE TO PARTNERSHIP
Basin & Channel Monitoring (Research)	U.S. Geological Survey	Improves understanding of how recharge happens and how quickly
Ephemeral Channel Infiltration Monitoring (Research)	U.S. Geological Survey	Improves understanding of infiltration from ephemeral channels into the aquifer
Precipitation Monitoring Stream Flow. (Research)	Agricultural Research Service	Improves understanding of what happens to storm water runoff in urbanized and non-urbanized areas
Stream Channel Reconnaissance (Research)	U.S. Geological Survey	Improves understanding of what happens to stream channel runoff
321 Report (Reporting)	U.S. Geological Survey	Meets congressionally mandated reporting requirement.

San Pedro RNCA Water Needs Study (Research)	U.S. Geological Survey Agricultural Research Service Arizona State University	Improves understanding of how much water the riparian system needs
Water Wise (Education)	Fort Huachuca-City of Sierra Vista-Cochise County	Community education program promotes water conservation in schools, community events, residences and businesses

Table 6: Project Development

	RESPONSIBLE AGENCY	VALUE TO PARTNERSHIP
Groundwater Model	U.S. Geological Survey	Developed by USGS with funding from USPP, this model provides state-of-art understanding of local hydrology to inform decision-making
Decision Support System	University of Arizona, SAHRA Institute	A user-friendly interface to the Groundwater Model Developed by the SAHRA institute at the University of Arizona for use by engineering and planning staff including Fort Huachuca in the Sierra Vista sub watershed.
Dry Well Project	Fort Huachuca	Pilot testing of the use of dry wells for enhancing the recharge of storm water generated from urban runoff.
Augmentation Alternatives (Wholesale)	Bureau of Reclamation	3 year appraisal level study to identify and evaluate alternative project scenarios to augment water supplies in the subwatershed
Water to the River (Wholesale)	Cochise County	Early stage project being evaluated for value as an interim solution to maintain baseflow during critical periods of low flow

Table 7: Wet water Projects: Wholesale and Retail

	RESPONSIBLE AGENCY	VALUE TO PARTNERSHIP
Bisbee effluent transfer & reuse project	Bisbee	Reduced ground water pumping by an estimated at 500 AFA
Huachuca City effluent transfer project	Huachuca City	Relocates out-of-compliance evaporative wastewater ponds away from the banks of the Babocomari River. Transfers effluent to Fort Huachuca for treatment and recharge or reuse.
Palominas Recharge Project	The Nature Conservancy	Easement or outright purchase under consideration to secure hydrologically sensitive lands.
Business Conservation Grants	Fort Huachuca-City of Sierra Vista-Cochise County	Promotes water conservation.
Toilet Rebate Program	City of Sierra Vista	Promotes water conservation.
Model Water Conservation Ordinance	Upper San Pedro Partnership	Promotes conservation among political subdivisions within the Sierra Vista Subwatershed

Fort Huachuca's role in the USPP – Funding

In September 2006, Fort Huachuca extended its Staff Assistance Contract with the City of Sierra Vista, which functions as fiscal agent for the USPP. With this action, it committed $86,000 to fund a

portion of the USPP's program administration, outreach, and water conservation grants. Fort Huachuca has also allocated an additional $93,000 for "water saving projects" to be developed in cooperation with the USPP. These funds will assist the Fort in achieving its water saving goals. To this end, the USPP has evolved a more flexible project development process to accelerate project implementation.

Fort Huachuca will continue to participate in the USPP and work toward maintenance of base flows in the San Pedro River. This may require regional partners to acquire and retire water rights in the area, balance water use with conservation and recharge projects, importing water, or any combination of these and other projects to attain a balance between ground water withdrawals and recharge. As mentioned above, Fort Huachuca will continue to provide leadership and significant technical and financial resources to help the USPP accomplish its purpose.

Water Conservation Business Grant Program

The water conservation business grant program was established by the USPP in 2004 with funds contributed by Fort Huachuca and BLM. The purpose of the program is to promote water conservation in the Sierra Vista Subwatershed business community through matching grants for implementing water conservation measures. Conservation measures could include replacing high-water-use fixtures with low- or no-water-use fixtures, replacing turf with drought tolerant plants, or implementing a new procedure/technique for reducing water used in a business process. The matching contribution can take the form of matching funds or in-kind services such as providing labor for installation. In-kind services can also include eliminating water wasting practices. The submittal of a grant application by a business is preceded by a visit from a Water Wise Specialist from the University of Arizona's Cooperative Extension Water Wise program.

The purpose of the visit is to assist the business with identification of potential water conservation measures and to provide assistance with completion of the grant application.

Spatially-Based Groundwater Mitigation

Section 321 of Public Law 108-136 requires the secretaries of the Interior, Agriculture, and Defense, and the USPP to report on measures needed to "restore and maintain the sustainable yield of the aquifer by and after September 30, 2011". This mandate, in turn, has been reflected in the USPP's effort to first define what sustainable yield means in the Sierra Vista Subwatershed, and second, to implement measures needed to attain that goal. While the USPP acknowledges that sustainable yield in the subwatershed includes a spatial aspect, they have as of yet not addressed that issue in their annual Section 321 reports. Rather, the USPP has focused on the more limited goal of arresting ground water storage depletion, at a minimum, and accreting ground water storage to some degree, as a first step toward achieving sustainable yield (DOI 2005, 2006).

Mitigation Goals

The legal context of consultation with the FWS distinguishes the Fort's position from that of the USPP. Rather than requiring the entire subwatershed to come into a sustainable yield condition, the consultation obligates Fort Huachuca to focus on the more direct issue of mitigating ground water pumping-related effects to endangered species and associated critical habitat in the subwatershed. In particular, the preservation of existing riparian and wetland habitat is viewed as being of paramount importance in this effort. Efforts to reduce net ground water consumption have an immediate impact

on ground water conditions within the cones of depressions of pumping wells and in the areas below recharge zones. Arresting or even diminishing ground water storage depletions in these areas has a definite long-term benefit to the natural discharge areas (rivers and springs) in the basin from which any pumped ground water is ultimately captured. However, the timing of any measurable beneficial impacts at the San Pedro River, for example, is uncertain but is definitely well into the future, possibly several decades or more. Furthermore, the spatial distribution of impacts at the San Pedro River from minor improvements in ground water storage change associated with pumping due to the presence of Fort Huachuca is uncertain. Predicting how ground water mitigation will affect ground water storage and capture (refer to discussion in the Water Budget Analysis, section 3.7.3.1, of the Revised PBA) requires sophisticated ground water modeling. Some percentage of improvements in ground water levels will eventually be reflected in improved streamflows, while some will be consumed by increased evapotranspiration (ET) by riparian vegetation.

In order to meet its legal obligation to mitigate potential pumping effects on endangered species in the San Pedro River riparian corridor, Fort Huachuca in cooperation with the USPP proposes to develop a targeted mitigation strategy. This proposal is reflected in the USPP's strategic plan as identified in the section titled *Regional Efforts through the Upper San Pedro Partnership*. The aim of this strategy would be to identify specific optimal sites and mitigation activities which would have a reasonably short-term (ideally less than 10 years) beneficial impacts to riparian habitat that supports federally listed threatened, endangered, and candidate species in areas potentially threatened by ground water pumping. The primary tool for this assessment would be a peer-reviewed, publicly accessible ground water model or Decision Support System linked to a ground water model. The model would be used to evaluate the anticipated impacts of ongoing mitigation activities on and off Fort Huachuca and to explore alternative mitigation sites and activities that may bring more immediate and focused improvements to critical habitat and endangered species threatened by ground water pumping. While not all of the ground water storage change attributable to the Fort may be directly replaced, the short-term improvements sought through targeted mitigation would be designed to provide more benefits to critical habitat and threatened and endangered species within the 10-year time frame described in the Revised PBA than mitigation efforts implemented at or near pumping centers. The proposed mitigation strategy will be designed to not only limit degradation of habitat but possibly improve it in a much shorter time and in a more measurable way than simply eliminating the ground water storage change in the vicinity of ground water pumping centers.

Quantification of Mitigation Requirement

Fort Huachuca proposes that, while working toward minimization of its ground water deficit through recharge and conservation measures, it will continue to work with the USPP to develop projects for the targeted mitigation of the ground water system. To this end, the Bureau of Reclamation (BOR), on behalf of the USPP, has been conducting an appraisal level study of water augmentation alternatives. The various augmentation alternatives under consideration involve the importation or development of water supplies that are at least, in part, independent of the regional ground water system. This "new" water would be used to bring near-term habitat protection and possibly improvement for threatened and endangered species in riparian corridors while the long-term process of ground water storage accretion occurs as a result of conservation and recharge. The initial modeling investigation will help identify potential mitigation project sites based on accessibility (legal and physical), availability of mitigation water, and potential for positive impact on critical habitat and threatened and endangered species. The USPP is currently seeking funds to conduct a formal feasibility analysis of several of the more promising augmentation alternatives in anticipation of eventual implementation.

Measurement of Mitigation Success
In order to measure the success of the projects, monitoring systems will be incorporated in the final project designs for the augmentation project(s) selected for implementation. These systems may include monitoring wells, water quality (temperature, conductivity, etc.) sensors, or other devices to quantify changes in ground- or surface water levels, soil moisture, or other indicators of water movement and habitat condition.

Summary

Appendix H in the Revised PBA includes a summary table of the various proposed on-Post water conservation, reuse, and recharge measures discussed previously. The year in which yields are first shown represents the expected year in which total annual project yields are first achieved. For example, under "Enhanced SW Recharge" Hatfield Basin yields begin in 2008 meaning that construction was completed some time in 2007 but full annual yields would not be realized until 2008. All estimated yields are relative to a 2005 baseline.

Prior mitigation projects have occurred, and yields are being accrued now and through both the short and long terms. The first four rows of data in Table 2 in the U.S. Geological Survey's *Water Management of the Region Aquifer in the Sierra Vista Subwatershed, Arizona—2005 Report to Congress* [321 Report: USDI 2006)] list the water yields associated with Fort Huachuca's past and ongoing water conservation efforts as well as the anticipated yields of future actions. A portion of the future water yields will be the result of targeted mitigation projects that will be identified and proposed to FWS by the end of 2007. Mitigation projects will be implemented according to a schedule agreed upon by the Fort and FWS, but will be designed to produce measurable progress toward critical habitat protection and improvement within 10 years.

Other Conservation Measures

Interagency Agreement

The 2004 Interagency Agreement between the Forest Service, Fort Huachuca, state of Arizona and regional fire departments is another conservation measure in that it provides for a coordinated fire suppression response that can minimize the effects of wildfire on Mexican spotted owls. The effects of fire management, including fire suppression, are discussed in Effects of the Proposed Action for each species, below. Fort Huachuca also has a real estate agreement with Department of Agriculture for maintaining an air tanker base at Libby Army Air Field. Although this activity uses moderate amount of water, it also directly supports fire fighting efforts that frequently protect listed species and critical habitat on Fort Huachuca and the Sierra Vista Subwatershed.

Erosion Control

Although watershed conditions on the post are generally good to very good, Fort Huachuca is committed to minimizing the effects of erosion. Fort Huachuca has taken several actions to identify, monitor and improve watershed conditions across the installation. These actions include: mesquite root-plowing, upland re-vegetation, gabions, erosion control structures, soils mapping, cooperative efforts with other Federal land managers, working with the Natural Resources Conservation District, and plant inventories. To reduce erosion, all off road vehicle traffic is also prohibited on the installation. A revised Policy for Off-Highway Vehicle (OHV) Operation on Fort Huachuca was signed by the Garrison Commander in September 2006. Any construction disturbance of more than one acre requires a Storm Water Pollution Prevention Plan. Most plan components include silt fencing, water bars, and other best management practices. Fort Huachuca is also retiring unnecessary roads and fire breaks.

Fort Huachuca is directing current erosion control efforts mainly toward improvements on the East Range. Certain areas are more prone to erode because of soil properties and less vegetation. Projected work will lower sediment loads, provide recharge, reduce velocity of storm water flows, and protect archeological sites on the East Range.

East Range
Based on the East Range Watershed Improvement Plan, the following work is scheduled or completed:

- Graveyard Gulch Retention Structure - (Completed)
- Soldier Creek Retention Structure - (Completed)
- West Soldier Creek Retention Structure - (Completed)
- Storm Water 1 – (Completed)
- Storm Water 2 – (Repair pending)
- Graveyard Gulch Retention Structure 2 – (Construction pending)
- Graveyard Gulch Retention Structure 3 – (Construction pending)
- East Range road closures – 81 miles (Completed)

Cantonment Area
There are also projects within the cantonment area which will reduce the potential impact of erosion. Status of these efforts is as follows:

- Greely Hall Detention Basin – (Completed) This was a conservation measure incorporated to reduce impacts from increased pavement for parking near Greely Hall.

- Cibeque Detention Basin – (Completed) This was a conservation measure incorporated to reduce impacts from increased pavement for parking near Kelly Operations building.

- Hatfield Detention Basin – Design Complete – Construction pending.

West Range
The post is also planning on a West Range Project retention structure which is pending.

South Range
The South Garden Basin which will provide ground water recharge is currently under construction.

Environmental Funding Sources and Process

Fort Huachuca typically invests $3.3 to $5.5 million per year in environmental, natural resources, and cultural projects. From 1997 through 2006, Fort Huachuca spent over $42M in those categories exclusive of the $12M spent for large construction (effluent recharge and extend effluent distribution system) projects. In the last few years, funding emphasis has shifted toward management of threatened and endangered species. In the past four years alone, over $10 million has been spent for conservation work with additional spending provided through other funding sources including water mitigation fees from organizations experiencing mission growth. Important projects completed during the last few years include geophysics (mapping of ground water reserves), purchase of conservation easements, vegetative mapping of the San Pedro RNCA, water conservation programs, surveys/research on threatened and endangered species, installation of artificial turf on athletic/physical training fields, etc.

The current situation within the Army and Department of Defense is fluid and changing with transformation (modernization of the fighting force), Global War on Terrorism, Operation Enduring Freedom, Operation Iraqi Freedom and major re-stationing. Due to the changing situation within Department of Defense, funding will be volatile over the period of action described in the Revised PBA. A strategy to accomplish the conservation measures associated with the proposed action is to define the base portion that will be accomplished each year and list the projects which will be accomplished over the next ten years.

The primary funding source to implement conservation measures is the Environmental Compliance Achievement Program (ECAP). This type of funding must be obligated between October 1 and September 30 of each fiscal year. While achieving the accomplishments under the 2002 BO, individual projects were programmed through the Environmental Program Requirements (EPR) process. That funding method was eliminated in September 2005. There have been changes in the type of funding as well. For example, the Graveyard Gulch Storm Water Retention Basin was constructed using conservation funding. Future basins will be funded with Sustainment, Rehabilitation and Modernization funding. Currently, funding for the environmental program (including threatened and endangered species-related projects) is provided through common levels of support. For example, rather than individual projects for monitoring individual species, annual funding will be provided for endangered species monitoring. Table 17 in the Revised PBA shows Fiscal Year 2007 funding which will be the baseline for the following years. There will be adjustments within projects due to yearly variation, cost of living increase, etc. but recurring requirements will remain constant.

Conservation measure projects for 2007- 2016, including funding status, are shown in Table 18 in the Revised PBA. Each year after receiving the approved funding plan, Fort Huachuca will schedule a work plan meeting with the FWS to discuss priorities, opportunities, revisions and develop the work plan. Project status will be included in the annual report.

Nine of the 26 water conservation actions found in Table 18 of the Revised PBA are definitively stated to be funded as of this writing. Seven of the 26 conservation actions involve ongoing funding, one involves military construction, and one is programmed. These projects appear, therefore, to already be backed by a clear and definite commitment of resources.

Eight of the 26 conservation actions appear to not yet be funded, but Table 18 includes projects that can be funded in future years, occurring as late as 2016. Given the long time frame for the currently-proposed action, and Fort Huachuca's success in accomplishing past water conservation actions, we consider the targeted mitigation projects to be reasonably certain to occur within 10 years, despite the lack of a clear and definite commitment of resources due to budgetary volatility. Annual coordination meetings between Fort Huachuca and FWS will offer opportunities to examine funding levels and accomplishments and to revise determinations on commitment of resources on an ongoing basis.

Funding for management of threatened and endangered species is included in the program management base (two biologists, a biologist technician, forester (lead on prescribed burning) and one ecologist). Program management costs are "must fund" requirements for the Army and thus can be considered to be backed by a clear and definite commitment of resources.

There are other Army funding sources for conservation measures. One is the MCA program. Approximately $12 million has been approved for Phase I and Phase II, Effluent Recharge and Reuse Project. Military pay is funded separately, and active Army individuals who expend significant time in support of endangered species compliance include the commanding general, garrison commander, Staff Judge Advocate, the Deputy Staff Judge Advocate, and the Public Affairs Officer. There are other civilian and contractor employees that provide important technical and legal support to the compliance program.

Another source of revenue comes from the water mitigation policy. Organizations that have an increased mission or new organizations coming to Fort Huachuca are required to pay a mitigation fee to offset the water usage associated with any increase in personnel numbers. Funding received for this mitigation will be used for water conservation, storm water retention or prevention of future water use.

Monitoring and Surveying of Listed and Candidate Species

Fort Huachuca has monitored listed, candidate and sensitive species and conducted surveys on a recurring basis. Funding has been requested for future years. Specifics are not included for annual surveys based on existing protocols since this process is well established. Additional detail for different monitoring periods or detailed requirements is in the Species Specific Conservation Measures subsection of the Description of the Proposed Conservation Measures section of this biological opinion, which addresses these species on an individual basis.

Protection of Listed and Candidate Species

Fort Huachuca has implemented numerous actions to protect federally listed threatened and endangered as well as candidate species and their habitat across the installation. These include, but are not limited to the following measures:

1. Off road travel and pyrotechnics are prohibited in agave management areas.

2. Off road travel is prohibited.

3. Warning signs and physical protection (i.e., boulders, fencing, etc.) have been completed and are being maintained.

4. Annual reports have been submitted and current year work plans developed. Fort Huachuca will continue to report and jointly develop work plans with the FWS.

Integrated Training Area Management

The US Army Integrated Training Area Management (ITAM) program is designed to provide sustainable training lands. There are four main components to the ITAM program: Range and Training Land Assessment, Sustainable Range Awareness, Land Rehabilitation and Maintenance (LRAM), and Training Requirements Integration. An ITAM coordinator was hired in 2001 and works in the Range Control Administration Office. Support includes Geographic Information Systems, environmental awareness, adherence to training restrictions, monitoring training areas, and projected funding for erosion control/watershed improvement and other training lands enhancement projects on the installation. Close coordination and a good working relationship exists with ENRD. Project funding is transferred via the Military Interdepartmental Purchase Request (MIPR) directly to ITAM.

Fire Management

During fire suppression, prescribed fire, and managed natural fire activities on the installation, the following measures shall be implemented:

1. One of the objectives of fire activities shall be protection of agave, LLNB, Huachuca water umbel, Mexican spotted owl and Sonora tiger salamander populations. This objective will not in any way constrain the Incident Commander (IC) from taking any action as needed to protect life or property.

2. A Resource Advisor(s) shall be on the fire during all activities. Resource Advisors shall be qualified to coordinate listed and sensitive species issues and serve as an advisor to the IC. They shall also serve as field contact representatives responsible for coordination with the FWS. They shall monitor fire activities to ensure the protective measures endorsed by the IC are implemented. Resource Advisors shall be on call 24 hours a day during the fire season.

3. Off-road vehicle activity shall be kept to a minimum. Vehicles shall be parked as close to roads as possible, and vehicles shall use wide spots in roads or disturbed areas to turn around. If off-road travel is necessary, local fire-fighting units should go off-road first because of their knowledge of the area.

4. Use of tracked vehicles shall be restricted to improving roads or constructing lines where a short distance of line might save a large area from fire.

5. The Fort shall, to the extent possible, obliterate vehicle tracks made during the fire, especially those of tracked vehicles.

6. Areas disturbed for crew camps, landing strips, staging areas, and any other new areas of disturbance created during the fire shall be kept to the minimum area possible and shall be located in previously disturbed sites whenever possible.

7. The Fort in coordination with the FWS shall develop a mitigation/monitoring plan for each prescribed fire, managed natural fire, or fuels treatment that may adversely affect listed species. The mitigation/monitoring plan shall ensure that adverse effects to listed species and their habitat are minimized. The effects of prescribed fire and fuels treatment on listed species and its habitat shall also be monitored. Mitigation/monitoring plans shall be approved by the FWS prior to implementing prescribed fire or fuels management. Mitigation and monitoring for managed natural fire that has the potential to affect listed species shall be coordinated with and approved by the FWS as part of a decision to let a natural fire burn under controlled conditions.

8. The Fort developed and implemented an Integrated Wildland Fire Management Plan in January 2006 to address suppression and prescribed fire. As part of the planning effort, the Fort established a schedule and implemented prescribed burns and/or fuels management to reduce fuel loading in Fort Huachuca woodlands, thereby reducing the potential for catastrophic fires.

9. The Fort Huachuca Fire Department will be present, when deemed necessary by the Fire Chief, on small arms firing ranges whenever tracer or other live-fire rounds are fired and will confine and contain any fires that are ignited.

10. Additional information is contained in specific species conservation measures and the project listing.

Recreation Management

Since September 2001, Fort Huachuca has been a closed post at times with access limited to authorized personnel. At lower threat levels, recreational access is permitted with vehicle registration and proof of insurance. Night travel is prohibited on secondary roads including Huachuca and Garden Canyons. Recreation management measures that have been implemented include:

- Boulder Placement and warning signs around known populations of Huachuca water umbel;

- Warning signs and Boulder Placement to Protect Upper Garden Canyon Pond, Tinker Pond and riparian areas;

- Recreational restrictions to protect Mexican spotted owls and critical habitat;

- Seasonal Closure and protection of LLNB roost sites;
- Closure of Gate 7 to all vehicles;
- Restricted vehicle access to include no off road vehicle use;
- Additional restriction on the use of live bait as outlined in the Fort's fishing fact sheet;
- Other measures are contained in the project list at the end of this section.

Environmental Awareness Education

The Fort shall continue to provide information and education (including protected resource identification) to military units, civilians, contractors and the general public. Range Scheduling, the ITAM coordinator and ENRD will ensure that units training on the installation become familiar with environmental policies and operational requirements. Personnel training in the Huachuca Mountains shall, through the environmental awareness training, be made aware of the protected status of listed species and these terms and conditions, but specific locations of listed species shall not be revealed unless absolutely necessary to protect the species.

Also, information shall be provided through the Newcomer's Briefing, Fort Huachuca 40-Hour Resource Conservation and Recovery Act (RCRA) course, Pre-Commander's Course, Fort Huachuca Conservation Committee, Environmental Quality Control Committee, and unit/organization briefings.

Integrated Natural Resources Management Plan

The Fort Huachuca Integrated Natural Resources Management Plan (INRMP) was completed in November 2001 in compliance with Public Law 105-85, Sikes Improvement Act of 1997 (16 USC 670 *et seq*). This plan provides the basis and criteria for protecting and enhancing natural resources using watershed, landscape, and ecosystem perspectives, consistent with the military mission. At a regional scale, the INRMP guides Fort Huachuca cooperation in renewable natural resources conservation at a landscape scale. Fort Huachuca plans to review the INRMP to ensure that the plan continues to help guide natural resources management on Fort Huachuca while supporting Fort Huachuca's military mission.

Agave Management Plan

The agave management plan was revised in 2006. The revised plan is included as Appendix D in the Revised PBA. The Fort will continue to implement this plan in order to maintain self-sustaining natural populations of *Agave palmeri*. The following guidelines delineate reasonable actions believed necessary for the long-term maintenance of stable agave populations on Fort Huachuca:

1. Prior to construction activities located in agave management areas, pre-construction surveys shall be conducted for paniculate agaves that may be directly affected by

construction activities. If agaves are found during pre-construction surveys, the following measures shall be implemented:

a. Disturbance shall be limited to the smallest area practicable, damage to agaves shall be avoided where possible, and projects shall be located in previously disturbed areas whenever possible.

b. Vehicle use shall be limited to existing routes and areas of disturbance except as necessary to access or define boundaries for new areas of construction or operation.

c. All workers shall strictly limit their activities and vehicles to designated areas. Construction workers shall be informed of these terms and conditions.

2. No seeding/planting of nonnative grasses or other plants shall occur at Fort Huachuca that may alter fire frequencies in wildland areas. However, seeding with hybrid sterile seeds in disturbed construction sites is authorized to establish a temporary ground cover for erosion control. This is only authorized during fall and spring when it is not feasible to seed with native species.

3. Prescribed fire and managed natural fire shall be planned to minimize adverse effects to lesser long-nosed bat forage plants and roosts. Measures shall be developed to ensure the following:

   a. Fires in agave management areas shall be actively suppressed unless the area is approaching its natural fire return interval of 10 years.

   b. Prescribed fire on the west range will be scheduled so that no more than ½ the agave management areas are burned in one year with no less than a two year waiting period before burning the remaining areas.

   c. A mitigation plan shall be developed by the Fort in coordination with the FWS for each prescribed or managed natural fire within 0.5 mile of a lesser long-nosed bat roost. The mitigation plan shall ensure those effects to lesser long-nosed bat roosts and forage plants are minimized and shall include monitoring of effects to forage plants. The FWS shall approve the plan. Mitigation and monitoring for managed natural fire shall be coordinated with and approved by the FWS as soon as possible after a decision is made to let a natural fire burn under controlled conditions.

   d. A schedule for prescribed burns shall be established and followed to reduce fuel loading in Fort Huachuca grasslands and woodlands, thereby reducing the potential for major wildfires in lesser long-nosed bat foraging and roosting habitat. This schedule shall be coordinated and approved by the FWS.

4. Nighttime training shall not occur in agave management areas from July 1 through October 31.

5. No nighttime use and no tracer fire shall occur on live fire ranges 2,3, and 4 from July1 through October 31.

6. Off-road vehicle travel shall not occur in protected agave management areas or any other part of the West Range or South Range.

7. Pyrotechnics shall not be used within 0.25 mile of protected agave management areas.

8. The Fort shall conduct monitoring of Palmer's agave populations on the West and South Ranges consistent with efforts of other agencies and research.

As monitoring efforts progress and more data become available, designated agave management areas may be modified as necessary. Modifications may include additions or deletions of designated areas.

Species Specific Conservation Measures

Huachuca Water Umbel (Endangered) with Critical Habitat

1. Fort Huachuca will conduct an inventory of all potential umbel habitat on the installation every four years with frequency transects conducted at documented umbel populations every other year in between the inventory years.

2. On the San Pedro RNCA, Fort Huachuca will conduct an inventory of all potential umbel habitats every three years with frequency transects conducted every year in between the inventory years. All inventory and monitoring activities will be conducted from September 15 through October 31 of each year.

3. The Fort shall maintain rock barriers around Huachuca water umbel populations.

4. The Fort shall continue with prescribed fire and fuel management in the Huachuca Mountains.

5. The Fort shall maintain the barrier to vehicle travel at Gate No. 7.

6. General fire coordination shall be accomplished as specified in the Fire Management subsection of the Description of the proposed Conservation Measures section of this biological opinion.

7. The Fort shall fund water umbel habitat management or restoration where habitat has been degraded or lost, or where potential exists for creating water umbel habitat. Assistance shall take the form of funding and/or technical assistance. Projects funded should include both off-post and on-post projects. On-post activities could include the propagation of HWU for use in site introduction and restoration and protection of cienega conditions in Garden Canyon and other wet sites. Off-post, the Fort could collect, propagate and plant HWU in suitable habitat along the San Pedro RNCA, as well as assist BLM, the Coronado National Forest, or other land owners/managers of water umbel habitat potentially affected by the proposed action. Off-post projects that the Fort should consider funding include cienega restoration or protection in Scotia Canyon or elsewhere

in the Huachuca Mountains, if approved by and coordinated with the Coronado National Forest, and restoration or protection of cienega conditions on the San Pedro RNCA, if approved by and coordinated with the BLM. All plans and agreements for funded projects shall be coordinated with and approved by the FWS.

8. The Fort shall monitor and document any disturbance of umbel or habitat. This and other monitoring required here will be reported to the FWS pursuant to the "reporting requirements" described below.

9. Fort Huachuca will continue with water conservation efforts, effluent recharge, purchase of conservation easements and storm water recharge efforts. These are described in greater detail in the Water-Related Conservation Measures subsection of the Description of the Proposed Conservation Measures.

10. Implement the Huachuca Water Umbel Endangered Species Management Plan by 2007.

11. All maintenance activities in Garden Canyon will occur within the existing roadbed or catch basins. Silt fencing is a best management practice that can be used where there is the potential for sediment to enter Garden Canyon Creek. No vegetation will be removed outside of the existing roadbed and no invasive plant or animal species will be introduced. No water will be used from Garden Canyon Creek. Contractors will be trained to recognize Huachuca water umbel and instructed to follow these conservation measures.

12. The Fort shall consider the closure and/or relocation of the Upper Garden Canyon picnic site.

Lesser Long-Nosed Bat (Endangered)

1. The Fort shall ensure that construction, upgrading, or maintenance of roads does not increase or facilitate public access to Manila Mine, Pyeatt Cave, or other day roosts identified during the life of the project.

2. The Fort has installed a new surveillance system because the previous system was unreliable. The system shall receive routine maintenance to ensure that it is properly functioning. Access routes at the closures and the mine/cave sites are posted with the following information: no vehicle access, no entry into mines or caves, explanations that the closures are needed to protect sensitive species, and warnings that entry into the mines/caves could represent a violation of the ACT. Fort Huachuca will continue to maintain the signs. Current access control will continue with no access from July 1 to October 31 unless bats are present which would expand the closure period.

3. Monitoring shall be conducted per the Monitoring and Surveying of Listed and Candidate Species subsection of the Description of the Proposed Conservation Measures section of this biological opinion..

4. The Fort shall prohibit low-level helicopter flights within 350 feet of Pyeatt Cave, Manila Mine, or other day roosts identified during the life of the project from July 1 to October 31, unless bats are present which would expand the prohibition.

5. Prior to construction activities, pre-construction surveys shall be conducted for paniculate agaves that may be directly affected by construction activities. If agaves are found during pre-construction surveys, the following measures shall be implemented:

    a. Disturbance shall be limited to the smallest area practicable, damage to agaves shall be avoided where possible, and projects shall be located in previously disturbed areas whenever possible.

    b. Vehicle use shall be limited to existing routes and areas of disturbance except as necessary to access or define boundaries for new areas of construction or operation.

    c. All workers shall strictly limit their activities and vehicles to designated areas. Construction workers shall be informed of these terms and conditions.

6. No seeding/planting of nonnative grasses or other plants shall occur at Fort Huachuca that may alter fire frequencies in wildland areas. However, seeding with hybrid sterile seeds in disturbed construction sites is authorized to establish a temporary ground cover for erosion control. This is only authorized during fall and spring when it is not feasible to seed with native species.

7. General fire coordination shall be accomplished as specified in the Fire Management subsection of the Description of the Proposed Conservation Measures section of this biological opinion. Also, the following measures will be implemented:

    a. Prescribed fire and managed natural fire shall be planned to minimize adverse effects to lesser long-nosed bat forage plants and roosts. Measures shall be developed to ensure the following:

        1) Fires in agave management areas shall be actively suppressed unless the area is approaching its natural fire return interval of 10 years.

        2) Prescribed fire on the west range will be scheduled so that no more than ½ the agave management areas are burned in one year with no less than a two year waiting period before burning the remaining areas.

        3) A mitigation plan shall be developed by the Fort in coordination with the FWS for each prescribed or managed natural fire within 0.5 mile of a lesser long-nosed bat roost. The mitigation plan shall ensure those effects to lesser long-nosed bat roosts and forage plants are minimized and shall include monitoring of effects to forage plants. The FWS shall approve the plan. Mitigation and monitoring for managed natural fire shall be coordinated with and approved by the FWS as soon as possible after a decision is made to let a natural fire burn under controlled conditions.

4) A schedule for prescribed burns shall be established and followed to reduce fuel loading in Fort Huachuca grasslands and woodlands, thereby reducing the potential for major wildfires in lesser long-nosed bat foraging and roosting habitat. This schedule shall be coordinated and approved by the FWS.

8. Nighttime training shall not occur in agave management areas from July 1 through October 31 or later date as long as lesser long-nosed bats are present on Fort.

9. No nighttime use and no tracer fire shall occur on live fire ranges 2, 3, and 4 from July 1 through October 31 or later date as long as lesser long-nosed bats are present on Fort.

10. From July 1 - October 31 or later date as long as lesser long-nosed bats are present on Fort, all nocturnal UAV operations at the Rugge-Hamilton and Pioneer sites will be above 500 feet agl, except for take-off and landings. Take-off and landing approaches at Rugge-Hamilton will be confined to the east and north and approaches at Pioneer will be confined to the north and west, away from agave management areas.

11. Off-road vehicle travel shall not occur in protected agave management areas or any other part of the West Range or South Range.

12. Pyrotechnics shall not be used within 0.25 mile of protected agave management areas.

13. The Fort shall continue to implement the endangered species management plan for the lesser long-nosed bat.

14. The Fort shall conduct monitoring of Palmer's agave populations on the West and South Ranges consistent with efforts of other agencies and research. The objective of the monitoring shall be to establish trends in bat forage resources.

15. Fort Huachuca shall continue to monitor around the Bergey wind turbine and wind data towers. If LLNB are found dead at the base of these structures, the Fort will initiate formal consultation.

16. The Fort shall monitor take of lesser long-nosed bats, document any disturbance of roost sites, and document acres burned on the West or South ranges and whether such fire burned in agave management areas. The results of this monitoring shall be reported to the FWS pursuant to the "reporting requirements" below.

Sonora Tiger Salamander (Endangered)

1. Fort Huachuca shall conduct annual monitoring of the upper Garden Canyon pond in June or early July (pre-monsoon) of each year to determine condition of the habitat and presence of aquatic salamanders according to protocol approved by the FWS.

2. General fire coordination shall be accomplished as specified in the Fire Management subsection of the Description of the Proposed Conservation Measures section of this biological opinion. One of the objectives of fire suppression activities shall be protection of salamanders and the aquatic habitat at upper Garden Canyon pond, in Scotia Canyon,

or other salamander localities possibly affected by fire at Fort Huachuca. This objective will not in any way constrain the fire boss from taking any action as needed to protect life or property.

3. The Fort shall develop objectives to be included in an Endangered Species Management Plan for the Sonora tiger salamander which will be completed by 2008.

4. The Fort will maintain boulders placed around the pond's perimeter at upper Garden Canyon Pond to prevent vehicles from driving through the habitat.

5. A closure to vehicle travel shall be maintained at Gate No. 7.

6. The Fort has amended the Fort Huachuca Fishing Fact Sheet and the Fort Huachuca web site to read, "Live fish and salamanders may not be transported or used as bait on Fort Huachuca. Capture, transport, or release of salamanders is strictly prohibited." This appears in bold.

7. The Fort shall maintain the permanent all-weather sign posted at upper Garden Canyon pond. The sign contains the following information: 1. Fishing, use of nets, and capture or release of salamanders or fish is prohibited, and 2. Off-road vehicle use is prohibited.

8. The Fort shall monitor take of Sonora tiger salamanders and document any disturbance of salamanders or salamander habitat. Results of this and other monitoring required herein shall be reported to the FWS pursuant to the "reporting requirements" below.

9. The Fort shall establish a schedule and continue to implement prescribed burns and/or fuels management to reduce fuel loading in Fort Huachuca woodlands in accordance with the Integrated Wildland Fire Management Plan for Fort Huachuca.

Southwestern Willow Flycatcher (Endangered)

1. The Fort shall maintain existing fire breaks on the East Range.

2. The Fort shall vigorously suppress any fire on the eastern third of the East Range, except in the impact area, and implement all portions of the proposed action and proposed conservation measures relevant to fire suppression.

3. If surveys confirm presence of southwestern willow flycatchers on Fort Huachuca, the Fort shall take action to ensure that fire ignited on the training ranges does not spread to flycatcher habitat and shall work with the FWS to develop and implement a plan to prevent any take of flycatchers.

4. The Fort has assessed habitat suitability for flycatchers at ASA points along the San Pedro River and none exists. Further habitat assessments of the ASA sites will be conducted on a periodic basis, as needed.

5. Monitoring shall be conducted every three years unless two or more nesting attempts are documented in one survey, in which case, monitoring will be conducted annually until the nesting attempts drop below two in one survey year. This includes habitat on Fort

Huachuca, at the Babocomari Cienega, if permission is obtained, and throughout the San Pedro RNCA in cooperation with the BLM. Surveys shall adhere to FWS protocol (Sogge *et. al.* 1997). Surveys shall include documenting flycatcher population size and distribution; identity of nesting birds (if banded); number of nesting attempts, clutch sizes, hatching success, fledgling success; causes of nest loss or failure; breeding season length; and habitat use.

6. The Fort shall monitor habitat conditions in the San Pedro RNCA and habitat acquired or for which easements/permission to enter are obtained. Aerial photos (1"=500 feet) were taken in 2000 and 2004 and shall be taken of the riparian corridor in 2019 and every fifteen years thereafter. Vegetation maps were developed in 2001 and 2005 and were constructed from photo series within one year of obtaining the photographs. Resolution of the maps shall be sufficient to map vegetation patches as small as 10 acres. Vegetation typing shall be by plant species composition and vertical structure/foliage density. Sufficient ground-truthing shall be conducted to assure reasonable accuracy of the mapping effort. Vegetation mapping in 2020 shall be accompanied by a trend analysis to determine gains or losses in flycatcher habitat.

7. The Fort shall assist BLM or other land owners/managers of habitat on the Upper San Pedro River with flycatcher habitat management, or restoration on retired agricultural lands, grazed areas, and in other areas where flycatcher habitat has been degraded or lost. Assistance shall take the form of funding and/or technical assistance. All plans and agreements for projects funded shall be coordinated with and approved by the FWS.

8. Fort Huachuca shall continue with water conservation efforts, effluent recharge, purchase of conservation easements and storm water recharge efforts.

Canelo Hills Ladies' Tresses (Endangered)

1. General fire coordination shall be accomplished as specified in the Fire Management subsection of the Description of the Proposed Conservation Measures section of this biological opinion. Historically, fires have been more likely to burn onto the West Range than to spread from Fort Huachuca property.

2. Fort Huachuca will maintain roads around the northwestern boundary of the installation, which act to inhibit the spread of fire.

3. Fort Huachuca will continue with water conservation efforts, effluent recharge, purchase of conservation easements and storm water recharge efforts.

Jaguar (Endangered)

General fire coordination shall be accomplished as specified in the Fire Management subsection of the Description of the Proposed Conservation Measures section of this biological opinion.

Mexican Spotted Owl (Threatened)

1. Fort Huachuca shall conduct annual monitoring of currently known PAC's and surveys of potential Mexican spotted owl habitat at Fort Huachuca in accordance with FWS survey protocol.

2. The Fort shall complete the endangered species management plan for the Mexican spotted owl that conforms to and complements the Mexican spotted owl Recovery Plan by 2008.

3. General fire coordination shall be accomplished as specified in the Fire Management subsection of the Description of the Proposed Conservation Measures section of this biological opinion. Also, the following measures will be implemented:

    a. Areas within PACs treated to reduce occurrence of wildfire, prescribed fire or fuels management shall be monitored, as described in the Recovery Plan, to determine effects of the treatment on known owl habitat components. If adverse effects are detected, treatments shall be modified to reduce those effects as much as possible while still reducing the risk of wildfire.

    b. One of the objectives of fire suppression activities in the Huachuca Mountains shall be protection of Mexican spotted owl PACs. This objective will not in any way constrain the incident commander from taking any action as needed to protect life or property.

    c. If a Mexican spotted owl is encountered during the fire, the Resource Advisor shall be advised immediately. The Resource Advisor shall assess potential harm to the owl and advise the incident commander of methods to prevent harm. The Resource Advisor shall maintain a record of any Mexican spotted owls encountered during suppression activities. The information shall include for each owl the location, date, and time of observation and the general condition of the owl, and response to the fire and fire activities.

    d. All fire suppression actions in PACs will occur, to the maximum extent possible, using "light on the land" methods, including not removing trees over 9 inches diameter at breast height (dbh) unless it is deemed necessary by the incident commander to prevent the fire from effecting additional PAC acres, or to protect life or property.

    e. Patches of unburned vegetation within burned areas in the Huachuca Mountains shall not be burned out as a fire suppression measure, except as needed to secure the fire perimeter or provide for fire fighter safety.

    f. The Fort in coordination with the FWS shall develop a mitigation/monitoring plan for each prescribed fire, managed natural fire, or fuels treatment that may adversely affect the Mexican spotted owl. Prescribed fire and fuels treatment shall be designed to protect Mexican spotted owls and their habitat.

    g. Treatments/prescribed fire shall not occur within a 100 acre area around spotted owl nest sites. This area shall include habitat that resembles the structural and floristic characteristics of the nest site. The 100 acre area will be

protected by using topographic and other barriers, or through line construction. All line construction in PACs will occur outside the Mexican spotted owl breeding season, will not remove any trees larger than 9 inches dbh unless they pose a threat to the safety of fire fighters, and will only occur with a wildlife biologist from the Fort on-site.

h. Treatments shall enhance or retain owl habitat components, such as downed large logs greater than 12 inches in midpoint diameter, hardwoods, grasses, forbs, and shrubs, while still reducing the chance of wildfire. In regard to downed logs, this shall be achieved by protecting 80-90 percent of the downed logs 12 inches diameter or larger, and hand-lining snags 18 inches dbh or larger for all managed natural fire actions within PACs.

i. Treatments shall produce a mosaic of habitat components within PACs.

j. Prescribed or managed natural fire shall be introduced in PACs in blocks of 100 acres or less, and only between September 1 and February 28, outside the Mexican spotted owl breeding season.

k. Prescribed or managed natural fire shall be introduced into potential Mexican spotted owl nest/roost habitat only if at least two years of surveys, in accordance with FWS protocol, have been conducted, and for which one year of follow-up survey (four visits) has been conducted, if more than one breeding season has elapsed since the last survey to protocol and the action. Furthermore, introduction of fire into PACs shall only occur if the nest/roost site is known the year of the action, or for which nest/roost site information is less than three years old. If nest/roost information for a PAC is three years old or more, a 200-acre nest buffer shall be deferred from treatment until such a time, as the nest/roost can be located again.

l. All prescribed or managed natural fire shall be suppressed if it is anticipated that the fire may burn out of prescription in the following 24 hours. The Fort may choose to suppress actions prior to this.

m. For prescribed or managed natural fire, the Fort shall ensure that no more than 10 percent of the canopy of each PAC will be affected by gaps created by single or groups of trees crowning. Groups of trees that "crown out" shall not exceed two acres in size.

n. The Fort shall ensure that no more than two PACs per year on Fort Huachuca are affected by prescribed or managed natural fire. A PAC is considered affected if one or more acres of the PAC are burned to any degree. If prescribed or managed natural fires in one year are located in PAC(s) outside of the nest buffer, and are 1-10 acres in size, the Fort will discuss with the FWS the option of allowing prescribed or managed natural fire to occur in one additional (or the same) PAC.

o. The effects of prescribed fire, managed natural fire, and fuels treatment on the owl and its habitat shall be monitored. Such monitoring shall include

quantifying acres of 100-acre activity centers, PACs, and potential habitat affected by these activities.

p. The FWS shall approve Mitigation/monitoring plans. Such plans shall be developed prior to implementation of prescribed fire. Mitigation and monitoring for managed natural fire that may adversely affect the Mexican spotted owl shall be coordinated with and approved by the FWS as soon as possible after a decision is made to let a natural fire burn under controlled conditions.

q. Areas of significant human activity during fire suppression operations, prescribed fire, or managed natural fire in the Huachuca Mountains such as fire crew camps, landing strips, and equipment staging areas, shall be located outside of PACs. Areas disturbed during fire suppression activities in the Huachuca Mountains such as fire lines, crew camps, and staging areas shall be rehabilitated. Including the obliteration of fire lines to prevent their use by vehicles or hikers.

4. Within canyons containing active Mexican spotted owl nests, or in canyons where occupancy or reproductive status is unknown, the Fort shall minimize low-level helicopter flights within 1.0 mile of the nest, or the site of the last previously known nest. Helicopter flights closer than 0.25 mile to active nests shall be prohibited from March 1-August 31.

5. If Mexican spotted owls are found nesting in Garden Canyon within 0.25 mile of the rappelling cliffs, rappelling shall be halted or moved at least 0.25 mile from the active nest from March 1 through August 31, or until nestlings fledge.

6. The Fort shall maintain the permanent all-weather sign near the Scheelite Canyon trailhead (but not visible from the Garden Canyon Road) that informs visitors of the following:

   a. The Canyon is home to sensitive species.

   b. Visitors should stay on the trail and be as quiet and unobtrusive as possible.

   c. Groups of visitors are limited to 12 or less.

   d. Calling, hooting, or playing of taped recordings to elicit responses from or to locate owls is prohibited in Scheelite Canyon without special permit from the FWS.

   e. Smoking is prohibited.

7. All maintenance activities in Garden Canyon will occur within the existing roadbed or catch basins and will only occur during the day. Silt fencing will be used where there is the potential for sediment to enter Garden Canyon Creek. No vegetation will be removed outside of the existing roadbed and no invasive plant or animal species will be introduced. No water will be used from Garden Canyon Creek. Contractors will be

trained to recognize Mexican spotted owls and instructed to follow these conservation measures.

8. The Fort shall monitor take of Mexican spotted owls and document any disturbance of owls or owl habitat. This and other monitoring required here will be reported to the FWS pursuant to the "reporting requirements" described below.

Bald Eagle (Threatened)

1. Fort Huachuca shall continue to monitor around the Bergey wind turbine and wind data towers. If bald eagles are found dead at the base of these structures, the Fort will initiate formal consultation.

2. Records of sightings on Fort Huachuca shall be maintained by ENRD.

Ramsey Canyon Leopard Frog (Conservation Agreement)

1. Fort Huachuca shall continue to meet obligations in the Conservation Agreement.

2. General fire coordination shall be accomplished as specified in the Fire Management subsection of the Description of the Proposed Conservation Measures section of this biological opinion.

3. Erosion control measures will be implemented as required to protect habitat.

4. Fort Huachuca will maintain existing habitat protection measures (signs, boulder placement, etc.).

Huachuca Spring Snail (Candidate)

1. General fire coordination shall be accomplished as specified in the Fire Management subsection of the Description of the Proposed Conservation Measures section of this biological opinion.

2. Species monitoring will be conducted periodically as needed.

3. Erosion control measures will be implemented as required to protect habitat.

4. Habitat protection measures (i.e., fencing, boulders, etc.) will be installed as needed.

Yellow-Billed Cuckoo (Candidate)

1. General fire coordination shall be accomplished as specified in the Fire Management subsection of the Description of the Proposed Conservation Measures section of this biological opinion.

2. Fort Huachuca will continue with water conservation efforts, effluent recharge, purchase of conservation easements and storm water recharge efforts.

3. Erosion control measures will be implemented as described in the Erosion Control subsection of the Description of the Proposed Conservation Measures section of this biological opinion.

Spikedace (Threatened)

1. General fire coordination shall be accomplished as specified in the Fire Management subsection of the Description of the Proposed Conservation Measures section of this biological opinion.

2. Fort Huachuca will continue with water conservation efforts, effluent recharge, purchase of conservation easements and storm water recharge efforts.

3. Erosion control measures will be implemented as described in the Erosion Control subsection of the Description of the Proposed Conservation Measures section of this biological opinion.

Reporting Requirements

For the duration of the proposed action, the Fort will prepare and deliver to the FWS annual reports documenting progress/results in implementation of all conservation measures. These will include actions taken, problems encountered, any take of listed species documented, copies of reports and data sheets for habitat monitoring and species surveys, effectiveness of the conservation measures, and recommendations on how to modify the measures to enhance protection of listed species or reduce needless hardship on the Fort or its contractors. Reports shall be due January 31 of each year.

As discussed in the Environmental Funding Sources and Process subsection of the Description of the Proposed Conservation Measures section of this biological opinion, each year after Fort Huachuca receives approved funding, an annual meeting will be held with the FWS to discuss development of an annual work plan. The annual work plan will contain all proposed actions the Fort plans to implement in the upcoming year to meet the requirements in this biological opinion. The annual meeting, work plan and report will serve as a key check and balance to ensure that Fort Huachuca is fulfilling its obligations under the Act.

Management Responsibilities

The US Army is responsible for managing all military and civilian activities on the Fort Huachuca military reservation. Fort Huachuca is currently under the management of the Installation Management Command (IMCOM). Fort Huachuca's installation management functions, including environmental management, fall under the West Regional Office, located in San Antonio, Texas.

Fort Huachuca is home to several military organizations including the US Army Intelligence Center (USAIC), the 111th Military Intelligence Brigade, US Army Network Enterprise Technology Command (NETCOM), the 11th Signal Brigade, the US Army Test and Evaluation US Army Electronic Proving Ground (EPG), the Joint Interoperability Test Center (JITC), and other partner activities. As the management and scheduling authority for all military activities on Fort Huachuca, the Army is responsible for adherence to all conservation measures.

To ensure that operations will be conducted in compliance with environmental requirements that come from this consultation, the Range Control Officer, Mr. T. Scott Miller will serve as management representative from the Range Control Operations office. This duty will be assumed by any replacement to the current Range Control Officer. This management representative has the authority to halt activities that are inconsistent with the BO. The management representative will routinely coordinate with Fort Huachuca's ENRD. The ENRD will in turn coordinate with the designated FWS representative on matters concerning this consultation.

All military units, agencies, and organizations using Fort Huachuca ranges and training areas are required to submit a range/training request to Range Scheduling, including information regarding the requested use, number, and types of troops and vehicles, and duration of training. Unit commanders will ensure that unit personnel are adequately trained in natural resource protection procedures, that the unit has adequate fire suppression capabilities, and that all restrictions or guidelines for training or testing are followed. Both the Range Control Operations Office and the ENRD will oversee unit activities and training in this regard. Failure to follow all range procedures could result in loss or limitation of range privileges at the discretion of the Range Control Officer.

The Range Control Officer is responsible for reviewing range/training area requests; maintaining a database of range usage and training man-hours; performing scheduled or unscheduled checks of ranges and training areas to ensure compliance with range use procedures; and limiting use of ranges as required by environmental conditions.

Timeline to Implement Conservation Measures

The table below establishes, by project, Fort Huachuca's commitment to accomplish the conservation measures detailed in the Revised PBA (see Table 19, below). Proposed projects for each year will be included in the annual work plan and discussed during the annual meeting with the FWS. The status of projects, additions or deletions, and any revision to this table will be coordinated with the FWS through the annual work plan, annual meetings, annual reporting, and informal or formal consultation – as appropriate.

While water conservation, recharge and reuse are an important part of the proposed action, other projects to support threatened and endangered species and their habitat are also important. Some individual project flexibility is intended in order to take specific advantage of opportunities in a given year. For example if an opportunity arose to purchase a conservation easement which significantly reduced agricultural pumping near the San Pedro River, funds could be reprogrammed from other projects to take advantage of that previously unforeseen opportunity.

Revised PBA Table 19: Conservation Measures Accomplished on an Annual Basis

Project	EPR	Estimated Cost	Comment
Comply with BO Water Management Plan (Annual Update)	HUAF010002	$ 50K	Assess progress and identify new technology
Comply with BO (USPP)	HUAF010003	$ 150-500K Contract	Fort Huachuca also provides substantial support (civilian and military employees)
Comply with BO (Agave Management)	HUAF980014	$ 30 - 50K	Burn mortality, inventory, etc.
Comply with BO Aquatic Species	HUAF980015	$ 35 - 90K	Inventory,, habitat protection, etc.
Implement ESMP Candidate Species	HUAF980016	$ 30K	Inventory,, habitat protection, etc.
Comply with BO Protect SWFFL	HUAF980018	$ 300 - 325K	Erosion control, fire protection, etc.
Comply with BO Peregrine/Mexican spotted owl	HUAS91-020	$ 40 -$60K	Survey, habitat protection, etc.
Comply with BO Fire Management	HUAS960003	$ 120 -170K	Burn plan, prescribed burn, thinning, etc.
Comply with BO MOA with Forest Service	HUAS960010	$ 20 – 30K	Provide funding for support
Meteorological Stations and Stream Gauging	HUAF010003 HUAF980015	$25 - $ 50K	Real time data and weather information
Comply with BO (LLNB)	HUAS960011	$ 40 - 50K	Monitor, maintain surveillance equipment, etc.
Implement INRMP Invasive Species	HUAF980020	$ 50 - 100K Contract	Inventory, prescribed burn, etc.
Implement ESMP Biological Assessments	HUAS960012	$ 10K	If required for supporting mission
Implement ESMP Subsurface Survey	HUAS960014	$ 100K	Normally with USGS
Update ESMP	HUAS010001	$ 25K	
Implement INRMP Environmental Awareness	HUAS030005	$ 30K	Posters, materials, GIS support
Implement ESMP Mexican spotted owl	HUAS950025	$ 50 – 60K	Habitat improvement, research, etc.
Implement ESMP Mountain Front Recharge	HUAS96	$ 100 - 150K	Detention basins, design, etc.
Manpower, Supplies, GSA Vehicles	HUAS020005	$ 306K	In house management efforts
Comply with BO (Umbel Flycatcher in San Pedro RNCA)	HUAF010004	$ 55K	Survey, report, etc.
Implement INRMP	HUAS96011	$ 125K	Nuisance wildlife, habitat improvement, etc.

Status of the Species and Environmental Baseline

The following sections provide background information of the species subject to formal consultation in this biological opinion. The sections entitled Status of the Species contain information on the respective species' taxonomy, life history, ecology as well as details on their administrative status including listing history, critical habitat designations, recovery planning, and consultation history. The sections entitled Environmental Baseline include descriptions of past and present impacts of all Federal, State, or private actions in the action area, the anticipated impacts of all proposed Federal actions in the action area that have undergone formal or early section 7 consultation, and the impact of State and private actions which are contemporaneous with the consultation process. The environmental baseline defines the current status of the species and its habitat in the action area to provide a platform from which to assess the effects of the action now under consultation.

The action area for the proposed action includes all areas directly and indirectly affected by the proposed action, including effects of actions that are interdependent and/or interrelated to the proposed action. Thus described, the action area includes all lands within the boundary of Fort Huachuca, the San Pedro River within the Sierra Vista Subwatershed, including the San Pedro RNCA, and the Babocomari River from below the Babocomari Cienega downstream to the confluence with the San Pedro River. Fort Huachuca also maintains off-post training sites, including a portion of the Willcox Playa (Cochise County), a parcel on Oatman Mountain (Mojave County), and leased land near Phoenix and Gila Bend (Maricopa County), Mount Graham (Graham County), and Mount Lemmon (Pima County), Arizona; and in Lordsburg, New Mexico. These are primarily ASA or communications sites, or vehicle pull-off sites along roadways where equipment is temporarily operated. Uses of each site are described in Appendix E of the Revised PBA. No additional threatened or endangered species are affected by electronic operations at these already-disturbed sites. Also note that not all species considered in the biological opinion occur throughout the greater action area; the areas where they are affected by the proposed action are described in their respective Environmental Baseline narratives.

Status of the Species – Huachuca Water Umbel

We listed the Huachuca water umbel as an endangered species on January 6, 1997 (FWS 1997a). Critical habitat was designated on the upper San Pedro River; Garden Canyon on Fort Huachuca; and other areas of the Huachuca Mountains, San Rafael Valley, and Sonoita Creek on July 12, 1999 (FWS 1999). The umbel is an herbaceous, semiaquatic perennial plant with slender, erect leaves that grow from creeping rhizomes. The species reproduces sexually through flowering and asexually from rhizomes, the latter probably being the primary reproductive mode. An additional dispersal opportunity occurs as a result of the dislodging of clumps of plants which then may reroot in a different site along aquatic systems.

The Huachuca water umbel has been documented from 27 sites in Santa Cruz, Cochise, and Pima counties, Arizona, and in adjacent Sonora, Mexico, west of the continental divide (Anderson 2006, Haas and Frye 1997, Saucedo 1990, Warren *et al.* 1989, Warren *et al.* 1991, Warren and Reichenbacher 1991, EEC 2001a, FWS files). The plant has been extirpated from 6 of the 27 sites. The 21 extant sites occur in four major watersheds - San Pedro River, Santa Cruz River, Rio Yaqui, and Rio Sonora. All sites are 3,500 to 6,500 ft. in elevation.

The Huachuca water umbel has an opportunistic strategy that ensures its survival in healthy riverine systems, cienegas, and springs. In upper watersheds that generally do not experience

scouring floods, the umbel occurs in microsites where interspecific plant competition is low. At these sites, the umbel occurs on wetted soils interspersed with other plants at low density, along the periphery of the wetted channel, or in small openings in the understory. The upper Santa Cruz River and associated springs in the San Rafael Valley, where a population of Huachuca water umbel occurs, is an example of a site that meets these conditions. The types of microsites required by the umbel were generally lost from the main stems of the San Pedro and Santa Cruz rivers when channel entrenchment occurred in the late 1800's to early 1900's. Habitat on the upper San Pedro River is recovering, and Huachuca water umbel has recently been found along short reaches of the main channel.

In stream and river habitats, Huachuca water umbel can occur in backwaters, side channels, and nearby springs. After a flood, it can rapidly expand its population and occupy disturbed habitat until interspecific competition exceeds its tolerance. This response was recorded at Sonoita Creek in August 1988, when a scouring flood removed about 95 percent of the Huachuca water umbel population (Gori *et al.* 1990). One year later, the umbel had recolonized the stream and was again codominant with watercress, *Rorippa nasturtium-aquaticum* (Warren *et al.* 1991). The expansion and contraction of Huachuca water umbel populations appear to depend on the presence of refugia where the species can escape the effects of scouring floods, a watershed that has an unaltered hydrograph, and a healthy riparian community that stabilizes the channel.

Density of umbel plants and size of populations fluctuate in response to both flood cycles and site characteristics. Some sites, such as Black Draw, have a few sparsely-distributed clones, possibly due to the dense shade of the even-aged overstory of trees, dense nonnative herbaceous layer beneath the canopy, and deeply entrenched channel. The Sonoita Creek population occupies 14.5 percent of a 500.5 square meter (5,385 square foot) patch of habitat (Gori *et al.* 1990). Some populations are as small as 1-2 square meters (11-22 square feet). The Scotia Canyon population, by contrast, has dense mats of leaves. Scotia Canyon contains one of the larger Huachuca water umbel populations, occupying about 57 percent of the 1,450 meter (4,756 foot) perennial reach (Gori *et al.* 1990, Falk and Warren 1994).

While the extent of occupied habitat can be estimated, the number of individuals in each population is difficult to determine because of the intermeshing nature of the creeping rhizomes and the predominantly asexual mode of reproduction. A population of Huachuca water umbel may be composed of one or many genetically distinct individuals.

Overgrazing, mining, hay harvesting, timber harvest, fire suppression, and other activities in the nineteenth century led to widespread erosion and channel entrenchment in southeastern Arizona streams and cienegas when above-average precipitation and flooding occurred in the late 1800's and early 1900's (Bahre 1991, Bryan 1925, Dobyns 1981, Hastings and Turner 1980, Turner *et al.* 2003, Hendrickson and Minckley 1984, Martin 1975, Webb and Betancourt 1992, Hereford 1993). A major earthquake near Batepito, Sonora, approximately 40 miles south of the upper San Pedro Valley, resulted in land fissures, changes in ground water elevation and spring flow, and may have preconditioned the San Pedro River channel for rapid flood-induced entrenchment (Hereford 1993, Geraghty and Miller, Inc. 1995). These events contributed to long-term or permanent degradation and loss of cienega and riparian habitat on the San Pedro River and throughout southern Arizona and northern Mexico. Much habitat of the Huachuca water umbel and other cienega-dependent species was presumably lost at that time.

Wetland degradation and loss continues today. Human activities such as ground water overdrafts, surface water diversions, impoundments, channelization, improper livestock grazing, chaining, agriculture, mining, sand and gravel operations, road building, nonnative species introductions, urbanization, wood cutting, and recreation all contribute to riparian and cienega habitat loss and degradation in southern Arizona. The local and regional effects of these activities are expected to increase with the increasing human population.

Dredging extirpated the Huachuca water umbel from House Pond, near the extant population in Black Draw (Warren *et al.* 1991). The umbel population at Zinn Pond in St. David near the San Pedro River was probably lost when the pond was dredged and deepened. This population was last documented in 1953 (Warren *et al.* 1991).

Livestock grazing can affect the umbel through trampling and changes in stream hydrology and loss of stream bank stability. However, existence of the umbel appears to be compatible with well-managed livestock grazing (FWS 1997a). In overgrazed areas, stream headcutting can threaten cienegas where the umbel occurs. Such headcutting occurs at Black Draw just south of the international boundary and at Los Fresnos, in the San Rafael Valley, Sonora. Groundwater pumping has eliminated habitat in the Santa Cruz River north of Tubac and threatens habitat in the San Pedro River. Severe recreational impacts in unmanaged areas can compact soils, destabilize stream banks, and decrease riparian plant density, including densities of the Huachuca water umbel. Populations in Bear Canyon in the Huachuca Mountains have been impacted by trampling and OHVs.

A suite of nonnative plant species has invaded wetland habitats in southern Arizona (Stromberg and Chew 1997), including those occupied by the Huachuca water umbel (Arizona Department of Water Resources 1994). In some cases their effect on the umbel is unclear. However, in certain microsites, the nonnative Bermuda grass, *Cynodon dactylon*, may directly compete with the umbel. Bermuda grass forms a thick sod in which many native plants are unable to establish. Watercress is another nonnative plant now abundant along perennial streams in Arizona. It is successful in disturbed areas and can form dense monocultures that can outcompete Huachuca water umbel populations.

Limited numbers of populations and the small size of populations make the Huachuca water umbel vulnerable to extinction as a result of stochastic events that are often exacerbated by habitat disturbance. For instance, the restriction of this taxon to a relatively small area in southeastern Arizona and adjacent Sonora increases the chance that a single environmental catastrophe, such as a severe tropical storm or drought, could eliminate populations or cause extinction. Populations are in most cases isolated, as well, which makes the chance of natural recolonization after extirpation less likely. Small populations are also subject to demographic and genetic stochasticity, which increases the probability of population extirpation (Shafer 1990, Wilcox and Murphy 1985).

Critical Habitat

The following areas are designated as critical habitat for Huachuca water umbel: 1.25 mi. of Sonoita Creek, 2.7 mi. of the Santa Cruz River, 3.4 mi. of Scotia Canyon, 3.8 mi. of Garden Canyon, and 33.7 mi. of the San Pedro River. There are other smaller reaches of streams on the Coronado National Forest that are included in the critical habitat designation.

The primary constituent elements identified in the final rule (FWS 1999) as necessary for the survival and recovery of the Huachuca water umbel include, but are not limited to, the habitat components which provide the following:

- Sufficient perennial base flows to provide a permanently wetted substrate for growth and reproduction of Huachuca water umbel;
- A stream channel that is stable and subject to periodic flooding that provides for rejuvenation of the riparian plant community and produces open microsites for water umbel expansion;
- A riparian plant community that is stable over time and in which non-native species do not exist or are at a density that has little or no adverse effect on resources available for water umbel growth and reproduction; and
- Refugial sites in each watershed and in each stream reach, including but not limited to springs or backwaters of mainstem rivers that allow each population to survive catastrophic events and recolonize larger areas.

Environmental Baseline - Huachuca Water Umbel

The portion of the action area in which Huachuca water umbel may be directly and/or indirectly affected includes those streams on Fort Huachuca in which the species occurs, and all Huachuca water umbel sites on the San Pedro River within the San Pedro RNCA and which are subject to the effects of ground water withdrawl.

As of 2005, there were fourteen populations of Huachuca water umbel on Fort Huachuca in Garden, Sawmill, and McClure Canyons within the South Range of the installation (PBA: Figure 31). Huachuca water umbel has been documented at sites in Garden Canyon since 1958 and in Sawmill Canyon since 1979 (EEC 2000a, 2001b). Warren and Reichenbacher (1991) surveyed Fort Huachuca for rare plant species from June to September 1989, and located Huachuca water umbel in upper Garden Canyon and at Sawmill Spring. Microhabitats where the plants were found were low-gradient cienega habitats with apparently permanent water and stable, non-eroded channels. The population in McClure Canyon was documented in 1997 (Hessil 1998). Since 2000, annual monitoring efforts have taken place on the Fort in these three watershed zones, and an installation inventory of potential habitat was completed in 1999, 2002, and 2005.

The 2005 Huachuca water umbel inventory (ENRD 2005) documented changes in the species' occurrence within the installation. As stated above, 14 populations were detected in 2005, whereas 22 populations were detected in 2002. Fort Huachuca staff hypothesized that drier conditions (absence of surface flow and/or greater depth to saturated soil) had contributed to a decline in Huachuca water umbel abundance and had favored slightly more mesic herbaceous plants such as deergrass (*Muhlenbergia rigens*).

Huachuca water umbel also occurs on the San Pedro RNCA. The San Pedro RNCA, which is managed by the BLM, includes roughly 57,000 acres in a strip approximately 36 miles long and 2.6 miles wide that runs from the international boundary north to about 3 miles south of St. David (but there is an approximate two mile gap in the San Pedro RNCA just north of Palominas and a section just north of Lewis Springs.) The purposes of the San Pedro RNCA as defined in the legislation are to conserve, protect, and enhance the riparian area and the aquatic, wildlife,

archeological, paleontological, scientific, cultural, educational, and recreational resources of the area. The legislation established a Federal reserve water right adequate to fulfill the purposes of the San Pedro RNCA. The riparian corridor through the San Pedro RNCA is one of the most extensive, contiguous reaches of cottonwood-willow gallery forests in the southwestern United States (BLM 1998).

The Huachuca water umbel was located in the San Pedro RNCA in 1994. Mark Fredlake (BLM, Sierra Vista, AZ), Peter Warren and Dave Gori (TNC, Tucson, AZ) located 43 patches of Huachuca water umbel during 1995 and 1996. Haas and Frye (1997) identified eight additional patches in 1997. These patches were found in six disjunct areas, including approximately 2 miles downstream of Fairbank, near Brunchow Hill upstream of Charleston, in the river at Lewis Springs, approximately one mile north and south of Highway 90, approximately 2.5 miles downstream of Highway 90, and from Hereford Bridge north for approximately 1 mile. Haas and Frye (1997) also documented the species on the San Pedro River approximately 0.5 mile south of the international boundary. Joanne Kirchner and Karen Blumenthal (EEC 2001b), under contract by the Fort, inventoried 51.0 km (31.7miles) of the 53.9 km (33.7 miles) of the designated critical habitat within the San Pedro RNCA. Kirchner and Blumenthal identified 43 populations during the inventory. Of these 43 populations, 17 appear to be new locations when compared with BLM records dated 1995-1999. Fort Huachuca contracted EEC to conduct the inventory again in 2004. During the inventory efforts, 30 populations were documented within the San Pedro RNCA (PBA: Figure 30). Fourteen of the 30 populations appear to be located at previously documented sites, based on Year 2001 data (EEC 2004).

The umbel is sensitive to flooding and populations may disappear while others become established during and after severe flood events. In 1999, Fredlake documented the absence of Huachuca water umbel in an historical site north of the Hereford Bridge/river crossing. In October 2000, a major flooding event occurred which restricted access to the River to conduct surveys. Fredlake re-documented this population during spring 2001 surveys. Additionally, Kirchner and Blumenthal documented this population during fall 2001 inventory. After the October flood in 2000, it appears that water umbel colonized downstream of the historically most densely populated areas within the San Pedro RNCA, demonstrating persistence by this plant in a natural functioning riverine system (EEC 2001b). Two patches of Huachuca water umbel on the San Pedro River were lost during a winter flood in 1994 and had not recolonized that area as of May of 1995, demonstrating the dynamic and often precarious nature of occurrences within a riparian system (Al Anderson, Grey Hawk Ranch, *in lit.* 1995). However, after high flows in 1996, no apparent loss or reduction in approximately 12 Huachuca water umbel patches was noted by Dr. Peter Warren (TNC, Tucson, pers. comm. 1997 as cited in the Revised PBA[a]). The entire San Pedro RNCA is considered potential habitat for the Huachuca water umbel. It is the largest contiguous potential habitat of the umbel, and as such is considered the most important site for recovery.

A series of large floods resulted in channel entrenchment between 1880 and 1908 (Hereford 1993), and possibly as late as 1926 (Jackson *et. al.* 1987). Flooding and downcutting left the river channel 3-30 feet below the former floodplain (Hereford 1993), which would have left most of the marshy bottomlands, and the habitat of the water umbel, high and dry. Completion of two

[a] References cited as personal communications appearing in the Revised PBA represent communication between Fort Huachuca staff and the investigators and thus are not contained in the FWS Administrative Record for this consultation.

cross-continental railways across Arizona in the 1880's, military conquest of the Chiricahua Apaches, and discovery of extensive silver deposits near Tombstone in the late 1870's spurred a boom in the mining and livestock industries and facilitated settlement and development of the area (Rogers 1965). Watershed degradation caused by extensive mining, wood cutting, and heavy grazing exacerbated the effects of unusually heavy rainfall, resulting in entrenchment of the river channel and loss of cienega habitats (Hereford 1993, ADWR 1994, Jackson *et. al.* 1987, Geraghty and Miller, Inc. 1995). Other factors that affected the distribution and abundance of cienega conditions on the San Pedro River include elimination of beavers (*Castor canadensis*) and a major earthquake (San Pedro Expert Study Team 1999, DuBois and Smith 1980, Geraghty and Miller, Inc. 1995). Through construction of dams, beaver probably contributed to the abundance of marshy, boggy conditions on the San Pedro River observed by explorers prior to entrenchment. However, because of overharvest, beaver were eliminated from the upper San Pedro, possibly near the turn of the century (Fredlake 1996). Following a major earthquake in 1887, the epicenter of which was located approximately 40 miles south of the upper San Pedro Valley, cienegas near St. David dried up, while in other areas artesian flows developed. The earthquake may have contributed to conditions that lead to channel entrenchment (Geraghty and Miller, Inc. 1995, Hereford 1993). With resulting loss of cienega conditions, the Huachuca water umbel probably became extremely limited in distribution or disappeared from the San Pedro River at this time. It was collected from the San Pedro River in 1958 (Warren *et. al.* 1989), which may have represented a remnant population.

Since entrenchment during 1880-1926, the river channel has widened substantially, peak flows have declined, sinuosity of the channel has increased, and riparian woodlands have developed on the floodplains (Hereford 1993). Hereford (1993) suggests that "increased sinuosity produced a reservoir effect that attenuated flood waves, and the development of floodplains enabled flood waters to spread laterally, thereby increasing transmission losses". Improvements in watershed condition and resulting increased infiltration and reduced runoff may have also contributed to reduced peak flows.

Few direct human impacts to umbel habitat in the San Pedro River have occurred since establishment of the San Pedro RNCA. However, recreation and associated impacts are becoming increasingly evident. Approximately 13 fires have burned within the San Pedro RNCA since its acquisition by BLM. In 1998, 780 acres of riparian woodlands and grasslands were destroyed. Another fire, apparently caused by a downed power line, burned approximately 800 acres in the San Pedro RNCA in March 1999. In May 2000, approximately 375 acres of habitat burned near Highway 90 bridge to Lewis Springs. The cause of the fires is unknown, but recreational activities are likely to increase the incidence of fire in the future. Recreation may be adversely affecting the umbel through trampling and bank erosion in some areas, particularly at the Highway 90 locality. Removal of most livestock after establishment of the San Pedro RNCA stimulated a recovery of riparian and wetland plant communities. Trespass cattle along the river were causing localized trampling of water umbel sites near the Highway 90 crossing in 1997, and continue to be a problem in some areas of the San Pedro RNCA, but the BLM has stepped up efforts to control trespass cattle. The immediate watershed of the upper San Pedro River continues to be degraded to some extent by livestock grazing. Disturbance of soils and cryptobiotic crusts, and removal of vegetation in the watershed by grazing combine to increase surface runoff and sediment transport, and decrease infiltration of precipitation (Belsky and Blumenthal 1997, Busby and Gifford 1981, DeBano and Schmidt 1989, Belnap 1992, Gifford and Hawkins 1978, Blackburn 1984). Degraded watershed condition due to grazing is particularly evident along Highway 90 north of Huachuca City where grasses have been largely

eliminated. Between 1974 and 1987, grassland communities in the USPB decreased in cover by 35 percent (EPA 1997) and have been replaced by desert scrub communities.

As mentioned above, the beaver was eliminated from the upper San Pedro River basin probably circa 1900. In 1999, The BLM and AGFD translocated several beavers into the San Pedro RNCA between the Hereford Bridge and the Highway 90 bridge. The effects of reestablishing beaver into the river system were the subjects of formal section 7 consultation between the FWS and BLM. In the BO, the FWS found that proposed reestablishment would not jeopardize the continued existence of the Huachuca water umbel. Beaver could facilitate reestablishment of cienega conditions through construction of dams and ponding of water. Effects on existing individual plants or populations of plants could not be determined and would depend on the location and extent of beaver activity and the level of success of the beaver reestablishment program. Beavers remain extant in the upper San Pedro and have been observed as far downstream (north) as San Manuel Crossing and Dudleyville.

The greatest threat to umbel habitat on the San Pedro River is continued ground water pumping in excess of recharge, which has the potential to lower ground water elevation under portions of the river, eliminate base flows, and result in desiccation of the riparian and wetland vegetation communities (BLM 1998, Stromberg *et. al.* 1996, ADWR 1994.) The hydrology of the upper San Pedro River basin and associated topics has been studied by numerous investigators, particularly in the last decade (as discussed previously in this section). Much of the recent work has been driven by concerns that ground water pumping in the Sierra Vista Subwatershed may result in declining ground water elevations and loss of baseflow and riparian values along the San Pedro River. The following narrative describes the baseline hydrologic conditions of the San Pedro River in greater detail and includes an analysis of relative risk faced by umbel inhabiting different stream reaches.

The San Pedro River through the San Pedro RNCA consists of perennial and intermittent reaches, with flows being generally more perennial in the upper reaches and becoming more intermittent as the river flows north. The USGS maintains three streamflow measuring stations on the San Pedro River. They include the Palominas Gage, Charleston Gage and the Tombstone Gage, with the Charleston gage being the only station with a substantially complete long-term record.

Many researchers have documented a long-term decline in flows at the Charleston gaging station (Koehler 2004; Corell *et al.* 1996; Corell 1996, Pool and Coes 1999; Thomas and Pool 2006, and others), but it has been more difficult to ascribe a cause to the observed declines in discharge. Thomas and Pool (2006), suggest that summer precipitation makes up the largest component of annual streamflow, but changes in summer precipitation were only partially responsible for the declines in streamflow at the Charleston Gage. Ultimately, Thomas and Pool (2006) concluded that changes in upland and riparian vegetation are the most likely causes for the observed streamflow declines because: (1) significant negative trends were observed in growing season (summer) flows but not in winter flows; (2) upland and riparian vegetation in the Upper San Pedro Basin has changed over the last century; and (3) since evapotranspiration makes up more than 90 percent of the discharge from the basin, even small changes in upland and riparian vegetation could have pronounced effects on flows in the river. Seasonal ground water pumping near the river was also recognized as having a significant impact, but ground water pumping from the regional aquifer far from the river (i.e., Sierra Vista/Fort Huachuca area) was not seen as having a major influence on stream flows at Charleston up to this point. Although Thomas

and Pool (2006) were able to estimate how much of the streamflow variability was attributable to precipitation, they were unable to determine what percent change or volume of total streamflow was attributable to changes in precipitation. Human activities were not considered significant factors in streamflow declines at the Charleston gage.

Long-term trends at the Tombstone gage are more difficult to predict owing to an incomplete gaging record and the intermittent nature of the stream below this gaging station. Modeling suggests that base flows have declined but no significant trends in flow with time were discernable from a statistical analysis of the data. A raster plot of zero flow days (see Figure 26, section 3.6.3.2 of the Revised PBA) suggests an increasing number of no-flow days in the fall and winter after 1996.

The temporal and spatial distribution and importance of storm flows stored in the banks of the San Pedro River and/or in the shallow alluvium below the river is the subject of much recent study. Pool and Coes (1999) found that regional ground water made up a relatively small proportion of baseflow between Palominas and Charleston in two consecutive spring seasons. They also concluded that storage of flood flows in both winter and summer wet periods is likely a key component of baseflow. Baille (2005) found that base flows in the San Pedro River were composed of 0 to 55 percent regional ground water and 45 to 100 percent monsoon floodwater, depending on variation in precipitation and whether or not the stream reach was gaining or losing.

Huachuca water umbel populations occur throughout the San Pedro RNCA, which can be divided into four reaches for discussion. These sections include: (1) the northernmost section from Fairbank to the northern boundary of the RNCA (Tombstone gage section); (2) from Charleston northward to Fairbank (Brunchow Hill section); (3) from Highway 90 north to Charleston (Lewis Spring section); and (4) from Hereford north to Highway 90 (near Hereford Bridge section).

Predicting which area might be affected first by declining ground water levels is problematic and dependent on the estimated rate of decline and current base flow at specific sites. An examination of current base flow at each locality suggests that populations near Brunchow Hill, about one mile downstream of Charleston, are perhaps the most resistant to water level changes. Base flow at the Charleston Gage is more than three times that at Palominas and less variable than flows at the Tombstone Gage (ASL 1995, Vionnet and Maddock 1992). At Brunchow Hill, if water levels continue to decrease (flows have been declining at this site - ASL 1994), water umbel habitat would likely move deeper into the river channel as flows declined. Huachuca water umbel would be extirpated from the area if water levels declined enough to de-water water umbel habitat for extended periods of time. Extirpation could also occur if the taxon was restricted to the bottom of the river channel and a large flood scoured out the channel. The San Pedro Expert Study Team (1999) noted that, although base flow at Charleston is dependably perennial, at times it is only barely perennial [flows as low as 0.05 cubic feet per second (cfs) have occurred in the last ten years - see Table 2 of their report]. Thus, although the population at Brunchow Hill may be more resistant to declining base flow than other populations, almost any reduction in flow will result in the river becoming intermittent in the Brunchow Hill-Charleston area.

The southernmost Huachuca water umbel locality in the San Pedro RNCA (from Hereford Bridge north for approximately one mile) is at the upstream end of the perennial reach where

base flows are relatively low. Low flows at Hereford are typically about 40 percent of low flows at Charleston, and periods of no flow have been recorded (Sharma *et al.* 1997). Increasingly intermittent flows and extirpation of the umbel could result if water levels decline at this site. Based on flow data from the BLM gage at the International Boundary, median flows at the site just south of the international boundary are probably about 2 cfs less than at Charleston, and periods of no flow occur.

Flows in the vicinity of water umbel population near the Tombstone Gage are highly variable. ASL (1994) notes that it is not uncommon for there to be no measurable flow at the Tombstone Gage. As a result, populations in this area would probably be extirpated if base flow declined much at all during May-June.

At the Lewis Springs site, where an umbel population occurs in the river, flows are somewhat more than 50 percent of flows at Charleston; periods of no flow have not been recorded (Sharma *et al.* 1997). Relatively low flows at Highway 90 (about one to two miles south of the Lewis Springs site) and Lewis Springs as compared to flows at Charleston, suggest populations at Lewis Springs and Highway 90 are more vulnerable to ground water decline than the population at Brunchow Hill (near Charleston). However, the lack of no flow periods at Lewis Springs and Highway 90 suggests populations at these sites may be able to sustain greater declines in flow than populations at Tombstone Gage, Hereford, or the site south of the international boundary, where the river currently goes dry periodically.

The predicted rate of ground water decline is the second factor in assessing risk of population extirpation. USGS (1998) believes "the San Pedro River above Charleston may not be as vulnerable to pumping from (Fort) Huachuca and Sierra Vista as the Babocomari River and the San Pedro River downstream of Charleston." The reach in the vicinity of the Babocomari confluence would be the first area affected by ground water pumping at Fort Huachuca and Sierra Vista, followed by the reach north of Charleston, and then the reach from Highway 90 to Charleston (Don Pool, pers. comm. 1999 as cited in the Revised PBA). A couple of water umbel populations occur near the Babocomari confluence (Tombstone gage population). Many populations of water umbel also occur in the perennial reach from Charleston north to the Babocomari, with several more populations occurring in the reach from Highway 90 to Charleston (at Brunchow Hill, Lewis Springs, and populations near Highway 90).

Flows in the vicinity of the populations near Hereford Bridge and near the international boundary will likely depend on the future of irrigated agriculture near the river both north and south of the border, and will likely not be affected by ground water pumping at Fort Huachuca and Sierra Vista. Although ground water elevation at Palominas, located between Hereford and the international boundary, has declined by about three feet since 1987 (ADWR 1994), Sharma *et al.* (1997) report that the percentage of flow contributed by ground water discharge has apparently increased at Hereford.

Status of the Species – Southwestern Willow Flycatcher

Listing and critical habitat

The southwestern willow flycatcher was listed as endangered, without critical habitat, in 1995 (FWS 1995). Critical habitat was later designated in 1997 (FWS 1997a). A correction notice was published in the Federal Register in 1997 to clarify the lateral extent of the designation (FWS 1997b).

In 2001, the 10th circuit court of appeals set aside designated critical habitat in those states under the 10th circuit's jurisdiction (New Mexico). The FWS decided to set aside critical habitat designated for the southwestern willow flycatcher in all other states (California and Arizona) until it could re-assess the economic analysis.

In 2005, the FWS re-designated critical habitat for the southwestern willow flycatcher (FWS 2005). A total of 737 river miles across southern California, Arizona, New Mexico, southern Nevada, and southern Utah were included in the final designation. The lateral extent of critical habitat includes areas within the 100-year floodplain.

A final recovery plan for the southwestern willow flycatcher was signed in 2002 (FWS 2002a). The Plan describes the reasons for endangerment and current status of the flycatcher, addresses recovery actions, includes detailed papers on management issues, and provides recovery goals. Recovery is based on reaching numerical and habitat-related goals for each specific Management Unit established throughout the subspecies range and establishing long-term conservation plans (FWS 2002a).

Description

The southwestern willow flycatcher is one of four currently recognized willow flycatcher subspecies (Phillips 1948, Browning 1993). It is a neotropical migrant that breeds in the southwestern U.S. and migrates to Mexico, Central America, and possibly northern South America during the non-breeding season (Phillips 1948, Peterson 1990, Howell and Webb 1995). The historical breeding range of the southwestern willow flycatcher included southern California, Arizona, New Mexico, western Texas, southwestern Colorado, southern Utah, extreme southern Nevada, and extreme northwestern Mexico (Sonora and Baja)(Unitt 1987).

Reasons for endangerment

Reasons for decline have been attributed primarily to loss, modification, and fragmentation of riparian breeding habitat, along with a host of other factors including loss of wintering habitat and brood parasitism by the brown-headed cowbird (Sogge *et al.* 1997, McCarthey *et al.* 1998). Habitat loss and degradation are caused by a variety of factors, including urban, recreational, and agricultural development, water diversion and ground water pumping, channelization, dams, and livestock grazing. Fire is an increasing threat to willow flycatcher habitat (Paxton *et al.* 1996), especially in monotypic saltcedar vegetation (DeLoach 1991) and where water diversions and ground water pumping desiccates riparian vegetation (Sogge *et al.* 1997). Willow flycatcher nests are parasitized by brown-headed cowbirds (*Molothrus ater*), which lay their eggs in the host's nest. Feeding sites for cowbirds are enhanced by the presence of livestock and range projects such as waters and corrals; agriculture; urban areas; golf courses; bird feeders; and trash areas. When these feeding areas are in or near flycatcher breeding habitat, especially coupled with habitat fragmentation, cowbird parasitism of flycatcher nests may increase (Hanna 1928, Mayfield 1977, Tibbitts *et al.* 1994).

Habitat

The southwestern willow flycatcher breeds in dense riparian habitats from sea level to about 8500'. Historical egg and nest collections and species' descriptions throughout its range describe the southwestern willow flycatcher's widespread use of willow (*Salix* spp.) for nesting (Phillips 1948, Phillips *et al.* 1964, Unitt 1987, San Diego Natural History Museum 1995). Currently, southwestern willow flycatchers primarily use Geyer willow (*S. geyeriana*), coyote willow (*S. exigua*), Goodding willow (*S. gooddingii*), boxelder (*Acer negundo*), tamarisk (*Tamarix* sp.), Russian olive (*Elaeagnus angustifolio*), and live oak (*Quercus agrifolia*) for nesting. Other plant species less commonly used for nesting include buttonbush (*Cephalanthus* sp.), black twinberry (*Lonicera involucrata*), cottonwood (*Populus* spp.), white alder (*Alnus rhombifolia*), blackberry (*Rubus ursinus*), and stinging nettle (*Urtica* spp.). Based on the diversity of plant species composition and complexity of habitat structure, four basic habitat types can be described for the southwestern willow flycatcher: monotypic willow, monotypic exotic, native broadleaf-dominated, and mixed native/exotic (Sogge *et al.* 1997).

Tamarisk is an important component of the flycatchers's nesting and foraging habitat in Arizona and other parts of the bird's range. In 2001 in Arizona, 323 of the 404 (80 percent) known flycatcher nests (in 346 territories) were built in a tamarisk tree (Smith *et al.* 2002). Tamarisk had been believed by some to be a habitat type of lesser quality for the southwestern willow flycatcher, however comparisons of reproductive performance (FWS 2002a), prey populations (Durst 2004), and physiological conditions (Owen and Sogge 2002) of flycatchers breeding in native and exotic vegetation has revealed no difference.

Open water, cienegas, marshy seeps, or saturated soil are typically in the vicinity of flycatcher territories and nests; flycatchers sometimes nest in areas where nesting substrates are in standing water (Maynard 1995, Sferra *et al.* 1997). Hydrological conditions at a particular site can vary remarkably in the arid Southwest within a season and among years. At some locations, particularly during drier years, water or saturated soil is only present early in the breeding season (i.e., May and part of June). However, the total absence of water or visibly saturated soil has been documented at several sites where the river channel has been modified (e.g. creation of pilot channels), where modification of subsurface flows has occurred (e.g. agricultural runoff), or as a result of changes in river-channel configuration after floods (Spencer *et al.* 1996).

The flycatcher's habitat is dynamic and can change rapidly: nesting habitat can grow out of suitability; saltcedar habitat can develop from seeds to suitability in five years; heavy runoff can remove or reduce habitat suitability in a day; or river channels, floodplain width, location, and vegetation density may change over time. For example, over-mature or young habitat not suitable for nest placement can be occupied and used for foraging and shelter by migrating, breeding, dispersing, or non-territorial flycatchers (Cardinal and Paxton 2005, McLeod *et al.* 2005). That same habitat may subsequently grow or cycle into habitat used for nest placement. Because of those changes, flycatcher "nesting habitat" is often described as occupied, suitable, or potential (FWS 2002a). Areas other than those where nests are located (foraging, sheltering, territory defense, singing, etc.) can also be "occupied flycatcher habitat," and as a result, essential to the survival and recovery of the flycatcher (FWS 2002a). The development of flycatcher habitat is a dynamic process involving maintenance, recycling, and regeneration of habitat. Flycatcher habitat can quickly change and vary in suitability, location, use, and occupancy over time.

Breeding Biology

Throughout its range the southwestern willow flycatcher arrives on breeding grounds in late April and May (Sogge and Tibbitts 1992, Sogge and Tibbitts 1994, Sferra *et al.* 1997). Nesting begins in late May and early June and young fledge from late June through mid-August (Willard 1912, Ligon 1961, Brown 1988, Sogge and Tibbitts 1992, Muiznieks *et al.* 1994). Southwestern willow flycatchers typically lay three to four eggs per clutch (range 1-5). Eggs are laid at one-day intervals and are incubated by the female for about 12 days (Bent 1960, Walkinshaw 1966, McCabe 1991). Young fledge about 12 to 13 days after hatching (King 1955, Harrison 1979). Typically one brood is raised per year, but birds have been documented raising two broods during one season and renesting after a failure (Whitfield 1990, Sogge *et al.* 1993, Whitfield and Strong 1995). The entire breeding cycle, from egg laying to fledging, is about 28 days.

Territory and Home Range Size

Southwestern willow flycatcher territory size likely fluctuates with population density, habitat quality, and nesting stage. Territories are established within a larger patch of appropriate habitat sufficient to contain several nesting pairs of flycatchers. Cardinal and Paxton (2005) found that the home ranges of telemetered flycatchers at Roosevelt Lake, Arizona, varied from 0.37 to 890 acres. Birds were found using a variety of riparian vegetation in a variety of conditions (open, young mature, exotic, mixed, etc.) and the distances moved indicate that birds can occupy a larger area and use more types of habitat than previously believed (Cardinal and Paxton 2005).

Movements

The site and patch fidelity, dispersal, and movement behavior of adult, nestling, breeding, non-breeding, and migratory southwestern willow flycatchers are just beginning to be understood (Kenwood and Paxton 2001, Koronkiewicz and Sogge 2001). Most southwestern willow flycatchers return to former breeding sites, although flycatchers can regularly move among sites within and between years (Kenwood and Paxton 2001). Within-drainage movements are more common than between-drainage movements (Kenwood and Paxton 2001). Year-to-year movements of birds have been detected between the San Pedro/Gila river confluence and Roosevelt Lake, the Verde River near Camp Verde and Roosevelt Lake, and the Little Colorado River near Greer and Roosevelt Lake (Kenwood and Paxton 2001). Typical distances moved range from 1.2 to 18 miles. However, long-distance movements of up to 137 miles have been observed on the lower Colorado River and Virgin River (McKernan and Braden 2001). Breeding groups of southwestern willow flycatchers act as a meta-population (Busch *et al.* 2000).

Rangewide Distribution and Abundance

Unitt (1987) documented the loss of more than 70 southwestern willow flycatcher breeding locations rangewide estimating the rangewide population at 500 to 1000 pairs. Since 1993, a total of 122 sites once known to have breeding flycatchers are no longer occupied by nesting birds. There are currently 265 known southwestern willow flycatcher breeding sites in the United States (all sites from 1993 to 2004 where a resident flycatcher has been detected) holding an estimated 1,256 territories (Durst *et al.* 2005). Numbers have increased since the bird was listed and some habitat remains unsurveyed; however, after nearly a decade of intense surveys,

the existing known numbers are just past the upper end of Unitt's 1987 estimate. About 40 percent of the 1,256 territories (Table 1) currently estimated throughout the subspecies' range is in three locations (Cliff/Gila Valley, Roosevelt Lake, San Pedro/Gila confluence).

Rangewide, the population is comprised mostly of extremely small, widely-separated breeding groups including unmated individuals. However, across the bird's range, 3 percent of all sites support greater than 50 territories (Durst *et al.* 2005).

The distribution of breeding groups is highly fragmented, often separated by considerable distance. In Arizona, about a 55-mile straight-line distance exists between breeding flycatchers at Roosevelt Lake and the next closest territories on the San Pedro River or Verde River. Long distances between breeding groups and small size of those populations reduces meta-population stability and increases the risks of local extirpation due to stochastic events, predation, cowbird parasitism, and other factors (FWS 2002a). Conversely, having about 40 percent of the entire subspecies at three locations can also create instability should catastrophic events occur that would remove or significantly reduce habitat suitability at those places. The survival and recovery of the flycatcher is not dependent on having a few locations with large numbers of birds, but rather properly distributed populations throughout the subspecies' range placed close together (FWS 2002a).

Arizona distribution and abundance

Unitt (1987) concluded that "...probably the steepest decline in the population level of *E.t. extimus* has occurred in Arizona..." Historic records for Arizona indicate the former range of the southwestern willow flycatcher included portions of all major river systems (Colorado, Salt, Verde, Gila, Santa Cruz, and San Pedro) and major tributaries, such as the Little Colorado River and headwaters, and White River.

The Arizona Game and Fish Department and other cooperators spent 2,710 hours surveying 184 sites covering approximately 186 linear kilometers (116 miles) of riparian ecosystems in 2006 (Graber *et al.* 2007). Surveyors detected 883 resident flycatchers at 47 sites. They located 483 flycatcher territories, in which 409 pairs were documented at 42 sites along 15 drainages. The major concentrations in low elevations (<1,115 meters/3,658 feet) occurred at the Winkelman Study Area (near the confluence of the Gila and San Pedro rivers), Roosevelt Lake (Salt River and Tonto Creek Study Areas), Big Sandy River Downstream US 93 (on the Big Sandy River near the US 93 bridge), and the Gila-Safford area (Gila River). Two high-elevation (>2,400 meters/>7,874 feet) sites with flycatchers were documented: one site on the Little Colorado River (Greer River Reservoir) and one on the San Francisco River (Alpine Horse Pasture). These represent data collected in 2006, the most recent year for which a statewide compilation has been made. Data collection for 2007 is underway at this writing.

Table 8. Rangewide population status for the southwestern willow flycatcher based on 1993 to 2004 survey data for Arizona, California, Colorado, New Mexico, Nevada, Utah, and Texas (Durst *et al.* 2005).

State	Number of sites with WIFL territories	Percentage of sites with WIFL territories	Number of territories[2]	Percentage of total territories

	1993-04[1]	1993-04		
Arizona[3]	112	42.3 %	544	43.3 %
California	91	34.3 %	200	15.9 %
Colorado	5	3.8 %	65	5.2 %
Nevada	13	4.9 %	68	5.4 %
New Mexico	36	13.6 %	372	29.6 %
Utah	3	1.1 %	7	0.6%
Texas	?	?	?	?
Total	265	100 %	1256	100 %

[1] Site boundaries are not defined uniformly throughout the bird's range.
[2] Total territory numbers recorded are based upon the most recent years survey information from that site between 1993 and 2004.
[3] More recent data are available for Arizona (Graber *et al.* 2007) but are: (1) not aggregated into a 1993 to 2006 series; and (2) are not accompanied by similar data for other states

While numbers have appreciably increased in Arizona, overall distribution of flycatchers throughout the state has changed little. Note that 85 percent of the growth in Arizona, since listing, has occurred at two locations. Recovery and survival of the flycatcher depends not only on numbers of birds, but territories and sites that are well distributed (FWS 2002a). Currently, population stability in Arizona is believed to be largely dependent on the presence of two large populations (Roosevelt Lake and San Pedro/Gila River confluence). Therefore, the result of catastrophic events or losses of significant populations either in size or location could greatly change the status and survival of the bird. Conversely, expansion into new habitats or discovery of other populations would improve the known stability and status of the flycatcher.

Fire

The evidence suggests that fire was not a primary disturbance factor in southwestern riparian areas near larger streams (FWS 2002a). Yet, in recent time, fire size and frequency has increased on the lower Colorado, Gila, Bill Williams, and Rio Grande rivers. The increase has been attributed to increasing dry, fine fuels and ignition sources. The spread of highly flammable tamarisk and drying of river areas due to river-flow regulation, water diversion, lowering of ground water tables, and other land practices is largely responsible for these fuels. A catastrophic fire in June of 1996, destroyed about a half mile of occupied tamarisk flycatcher habitat on the lower San Pedro River, and resulted in the forced dispersal or loss of up to eight pairs of flycatchers (Paxton *et al.* 1996). Smaller fires have occurred along the upper most portion of the San Pedro River closer to the Mexico Border and another large fire occurred on the lower San Pedro River at the Nature Conservancy's San Pedro Preserve between Winkelman and Dudleyville in 2004. Recreationists cause over 95 percent of the fires on the lower Colorado River (FWS 2002a). In California, Brothers (1984) attributed increased fire along the Owens River to more use of the riparian zones by campers and fishermen in the previous 30 years.

Mortality and Survivorship

There are no extensive records for the actual causes of adult southwestern willow flycatcher mortality. Incidents associated with nest failures, human disturbance, and nestlings are typically the most often recorded due to the static location of nestlings, eggs, and nests. As a result, nestling predation and brood parasitism are the most commonly recorded causes of southwestern willow flycatcher mortality. Band returns at Roosevelt Lake determined that the average adult return rate from 1998 to 2004 was 60 percent with survivorship estimated at 65 percent (Newell *et al.* 2005). From 1998 to 2004, the average nestling return rate was 28 percent and survivorship estimated at 35 percent (Newell *et al.* 2005).

Reproductive Success

Intensive nest monitoring efforts in California, Arizona, and New Mexico have shown that cowbird parasitism and predation can result in the following: failure of the nest; reduced fecundity in subsequent nesting attempts; delayed fledging; and reduced survivorship of late-fledged young. Cowbirds have been documented at more than 90 percent of sites surveyed (Sogge and Tibbitts 1992, Camp Pendleton 1994, Sogge and Tibbitts 1994, Holmgren and Collins 1995, Maynard 1995, San Diego Natural History Museum 1995, Sogge 1995, Skaggs 1996, Whitfield and Enos 1996, Tomlinson 1997, McCarthey *et al.* 1998). The probability of a southwestern willow flycatcher successfully fledging its own young from a cowbird parasitized nest is low (i.e. <5 percent). Also, nest loss due to predation appears consistent from year to year and across sites, generally in the range of 30 to 50 percent.

Past Consultations

Since listing in 1995, approximately 150 Federal agency actions have undergone formal section 7 consultation throughout the flycatcher's range to 2007. Many activities continue to adversely affect the distribution and extent of all stages of flycatcher habitat throughout its range (development, urbanization, improper grazing, recreation, native and non-native habitat removal, dam operations, river crossings, ground and surface water extraction, etc.). Stochastic events also continue to change the distribution, quality, and extent of flycatcher habitat.

Anticipated, actual, or temporary loss of flycatcher habitat due to Federal actions (i.e. modification of Roosevelt Dam, operation of Lower Colorado River dams, etc.) has resulted in biological opinions and Habitat Conservation Plans that led to acquisition, development, and protection of property specifically for the southwestern willow flycatcher to remove jeopardy, and mitigate, reduce, or minimize take or adverse effects. A small portion of the lower San Pedro River was acquired by the Bureau of Reclamation as a result of raising Roosevelt Dam and is now under the management of The Nature Conservancy. Commitments to acquire and manage unprotected habitat specifically for breeding flycatchers have been made for loss of flycatcher habitat along the Lower Colorado River (Operations of Colorado River dams and 4.4 Plan/Change in Points of Diversion, Lower Colorado River MSCP), Tonto Creek and Salt River (raising of Roosevelt Dam, operation of Roosevelt Dam) in Arizona, and Lake Isabella, California (operation of dams). The Roosevelt Lake HCP completed by Salt River Project (SRP) has resulted in acquisition of over 1000 acres along the Verde, San Pedro, and Gila rivers. The Army Corps of Engineers has acquired approximately 1000 acres along the South Fork Kern River as a result of operations of Isabella Dam. Various Regional HCPs have been developed in southern California that have protected southwestern willow flycatcher habitat.

Environmental Baseline – Southwestern Willow Flycatcher

The subset of the action area pertaining to the southwestern willow flycatcher includes all habitat that may be affected by the proposed action, primarily on the Babocomari and San Pedro rivers. Regarding the San Pedro River, hydrologic analyses conducted by Fort Huachuca (see Revised PBA) have concluded that measurable effects to the surface baseflow of the San Pedro River are not discernable downstream from the Sierra Vista Subwatershed boundary, located near St. David and therefore, effects to these downstream reaches, including the critical habitat designated for them, are not analyzed herein.

The San Pedro River contains an appreciable concentration of southwestern willow flycatchers, with the species occurring in large numbers in the Winkleman Study Area, near the confluence of the Gila and San Pedro rivers. A total of 124 flycatchers were known to fledge from nests in the Winkleman Study Area in 2005, the last year that included comprehensive surveys of the lower San Pedro River (English *et al* 2006). The middle San Pedro, situated between approximately St. David and the Narrows near Cascabel, receives little, if any, survey effort, and the status of birds in the middle reaches is largely unknown.

The appreciably lesser numbers of southwestern willow flycatchers on the upper San Pedro River relative to the numbers observed on the lower San Pedro River is hypothesized to be due to the upper river's relatively narrow corridor of riparian forest, a lack of understory in most areas, and a history of grazing that probably reduced understory foliage density on the upper San Pedro River. In addition, tamarisk, which when in dense stands is an important nesting substrate on the lower San Pedro River, is limited in extent in the upper reaches.

Foliage density in the upper San Pedro River's understory appears to have been increasing steadily since livestock were removed from the San Pedro RNCA shortly after its establishment in 1988. Nesting by riparian-associated bird species has increased in a relatively short time (EEC 2001c). If this trend continues, more southwestern willow flycatchers will likely be found in the San Pedro RNCA in the future. The upper San Pedro River will also continue to serve as a migration corridor for southwestern willow flycatchers moving between wintering grounds in Latin America and the middle and lower reaches of the San Pedro River or other sites to the north. Skagen (1995) recorded no willow flycatchers on the upper San Pedro River during April and early May 1989-1994, although flycatchers, including some nesting pairs, have been detected during surveys from 1996 to 2005.

Southwestern willow flycatchers were found to be nesting on the upper San Pedro River near St. David in 1996. One southwestern willow flycatcher nest was found near Kingfisher (or Young-Block) ponds in the San Pedro RNCA near the Highway 90 crossing (McCarthey *et. al.* 1998) in 1997. The Kingfisher Pond site was abandoned in July, and a dead cowbird chick was found in the abandoned nest (SAIC 1998a). Early in the season, two territorial males were found upstream, and a third was located downstream of Kingfisher Pond (T. McCarthey, AGFD, pers. comm. 1997 as cited in the Revised PBA). SAIC (1998b) conducted southwestern willow flycatcher surveys along 17.1 miles in six reaches of the upper San Pedro River in May-July 1997. Surveys were conducted according to FWS protocol in five of the six reaches. No southwestern willow flycatchers were detected during these surveys. In 1998, one southwestern willow flycatcher was detected at Kingfisher ponds on June 8, but it is unknown if this bird was a migrant or a breeding bird. An apparent migrant was seen on June 4, 1998 at Hereford Bridge, but was not observed in subsequent surveys (Paradzick *et. al.* 1999, 2000). Also in 1998, three

territorial males were found on the San Pedro River at Apache Powder Road, just north of the San Pedro RNCA, but it is not known if these birds were paired or if nests were present (T. McCarthey, pers. comm. 1998 as cited in the Revised PBA). In 1999, two willow flycatchers, probably migrants, were detected in late May and early June at Kingfisher Ponds (T. McCarthey, pers. comm. 1999 as cited in the Revised PBA). EEC, contracted by Fort Huachuca from 2000-2006, conducted comprehensive surveys for the species on the upper San Pedro RNCA. No southwestern willow flycatchers were detected along the San Pedro RNCA during 2000 and 2001 surveys. However, an incidental sighting was observed by Jack Whetstone (BLM) while conducting weekly surveys at the Monitoring Avian Productivity and Survivorship (MAPS) bird banding station near Kingfisher pond both in August 2000 and 2001 (Whetstone, pers. comm. 2000 and 2001 as cited in the Revised PBA). Three migrant southwestern willow flycatchers were detected in 2002, and two migrants were detected in 2003 and 2004. One breeding pair was detected during the third survey period in 2005. The nest was located south of the then-unusable Hereford Road Bridge on the west bank of the river. EEC monitored the nest from July 8 to August 3, 2005. Two eggs were originally observed, however, nest failure was determined on August 3, 2005, possibly due to heavy river flows and elevated stages that caused vegetation damage. No southwestern willow flycatchers were detected on the San Pedro RNCA during the 2006 survey season.

The Babocomari River has not been well surveyed for southwestern willow flycatchers; however, most of the habitat on the river is probably unsuitable due to intermittent flows and lack of sufficient riparian vegetation cover (Dave Krueper, BLM, Sierra Vista, AZ, pers. comm. 1998 as cited in the Revised PBA). The Babocomari Cienega, located on the Babocomari River upstream of Huachuca City at the Babocomari Ranch, may have potential to support nesting southwestern willow flycatchers (D. Krueper, pers. comm. 1998 as cited in the Revised PBA). The area consists of an impoundment, possibly an impounded spring, surrounded by a healthy stand of cottonwoods, and farther upstream, a thick stand of short willows (Susan Skagen, USGS, Biological Resources Division, pers. comm. 1998 as cited in the Revised PBA). Avian surveys from April 3 to May 14 over a four year period (1989, 1991, 1993, 1994) resulted in no observations of willow flycatchers (Skagen 1995), but southwestern willow flycatchers do not begin building nests until late May. Riparian woodlands above and below the cienega consist mostly of decadent, old cottonwoods and a relatively low proportion of foliage density in the understory. This may reflect a lack of recruitment possibly due to heavy grazing that occurs in the area (Skagen 1995; S. Skagen, pers. comm. 1998 as cited in the Revised PBA). However, a decline in ground water elevation could have the same effect on cottonwood demographics. EEC, contracted by the Fort from 2003 - 2006, conducted comprehensive surveys for the species on the Babocomari Cienega. No southwestern willow flycatchers have been detected within the cienega.

Riparian vegetation suitable for nesting southwestern willow flycatchers is generally lacking at Fort Huachuca. R.B. Duncan (in SAIC 1998a) reported a small patch of marginal habitat (no more than 10 acres of cottonwoods and wetland vegetation) near Highway 90 just north of the main gate; however, this habitat no longer exists as a result of a fire in May of 1999 (EEC 2000b). The riparian vegetation is likely to recover and may develop into potential habitat in future years. Marginal habitat for flycatchers may also occur on-post at Gravel Pit Pond and Middle Garden Canyon Pond. These sites, previously classified as potential breeding habitat, were re-evaluated in May 2000. These areas were classified as unsuitable nesting habitat through an on-sight evaluation based on current described and classified plant species composition and habitat structure used by the southwestern willow flycatcher for nesting (EEC 2000b).

The establishment of the San Pedro RNCA has greatly reduced the level of livestock grazing from an estimated 9,000 head to occasional trespass cattle after the conservation area was fenced. Other land uses potentially damaging to riparian plant communities such as gravel mining and off-road vehicle use have also been eliminated in the San Pedro RNCA (BLM 1989). The result has been a substantial recovery of the riparian vegetation, a large increase in breeding bird species diversity and abundance (Krueper 1993), and, in 1997, one pair of nesting southwestern willow flycatchers. However, cowbirds are common along all sections surveyed in the San Pedro RNCA and it is expected that this species will continue to be common given that the San Pedro RNCA is surrounded by open habitat that is grazed by livestock. Brown-headed cowbirds were common at the Babocomari Cienega and on the upper San Pedro River in April and May 1989-1994 (Skagen 1995) and on the upper San Pedro River in May and June 1997 (SAIC 1998b). McCarthey *et. al.* (1998) report that brown-headed cowbirds were present at the flycatcher localities on the upper San Pedro River in 1997; and the one nest in 1997 was parasitized by cowbirds (SAIC 1998a). Therefore, the potential for continued cowbird brood parasitism of the southwestern willow flycatcher and other nesting birds in the San Pedro RNCA is high. The only livestock grazed on Fort Huachuca are horses at the Buffalo Corral; eight surveys for cowbirds at this site in 1997 resulted in the observation of one transient bird (Chase 1997; SAIC 1997a). Therefore, horse grazing at Buffalo Corral on Fort Huachuca does not appear to be contributing to the local cowbird population.

Status of the Species – Mexican Spotted Owl

The Mexican spotted owl was listed as a threatened species in 1993 (USDI 1993). Critical habitat for the species was designated in its current form on August 31, 2004 (69 FR 531982). The Final Rule listing the species stated that the primary threats to the species were even-aged timber harvest and the threat of catastrophic wildfire, although grazing, recreation, and other land uses were also mentioned as possible factors influencing the Mexican spotted owl population. We appointed the Mexican spotted owl Recovery Team in 1993, which produced the Recovery Plan for the Mexican spotted owl (Recovery Plan) in 1995 (USDI 1995). The Recovery Plan is currently being revised and may be released for public review in 2007.

A detailed account of the taxonomy, biology, and reproductive characteristics of the Mexican spotted owl is found in the Final Rule listing the Mexican spotted owl as a threatened species (USDI 1993) and in the Recovery Plan (USDI 1995). The information provided in those documents is included herein by reference. Although the Mexican spotted owl's entire range covers a broad area of the southwestern United States and Mexico, the Mexican spotted owl does not occur uniformly throughout its range. Instead, it occurs in disjunct localities that correspond to isolated forested mountain systems, canyons, and in some cases steep, rocky canyon lands. Surveys have revealed that the species has an affinity for older, well-structured forest, and the species is known to inhabit a physically diverse landscape in the southwestern United States and Mexico.

The U.S. range of the Mexican spotted owl has been divided into six recovery units (RU), as discussed in the Recovery Plan. The primary administrator of lands supporting the Mexican spotted owl in the United States is the Forest Service. Most owls have been found within Forest Service Region 3 (including 11 National Forests in Arizona and New Mexico). Forest Service Regions 2 and 4 (including 2 National Forests in Colorado and 3 in Utah) support fewer owls. According to the Recovery Plan, 91 percent of Mexican spotted owls known to exist in the

United States between 1990 and 1993 occurred on lands administered by the Forest Service.

A reliable estimate of the numbers of owls throughout its entire range is not currently available (USDI 1995) and the quality and quantity of information regarding numbers of Mexican spotted owl vary by source. USDI (1991) reported a total of 2,160 owls throughout the United States. Fletcher (1990) calculated that 2,074 owls existed in Arizona and New Mexico. However, Ganey (1998) estimates 600-1,200 Mexican spotted owls inhabit Arizona and in 2000. Ganey *et al.* (2004), however, estimated approximately 2,950 ± 1,075 Mexican spotted owls in the Upper Gila Mountains RU alone. The Forest Service Region 3 most recently reported a total of approximately 987 protected activity centers (PACs) established on National Forest lands in Arizona and New Mexico (USDI 2005). Based on this number of Mexican spotted owl sites, total numbers in the United States may range from 987 individuals, assuming each known site was occupied by a single Mexican spotted owl, to 1,960 individuals, assuming each known site was occupied by a pair of Mexican spotted owls. The Forest Service Region 3 data are the most current compiled information available to us; however, survey efforts in areas other than National Forest System lands have likely resulted in additional sites being located in all Recovery Units. Currently, we estimate that there are likely 12 PACs in Colorado (not all currently designated) and 105 PACs in Utah.

The current condition of Mexican spotted owl habitat within Arizona and New Mexico is a result of historical and recent human use, as well as climate change, vegetative species conversion, and wildfires. Historical and current anthropogenic uses of Mexican spotted owl habitat include both domestic and wild ungulate grazing, recreation, fuels reduction treatments, resource extraction (e.g., timber, oil, gas), and development. These activities have the potential to reduce the quality of Mexican spotted owl nesting, roosting, and foraging habitat, and may cause disturbance during the breeding season. Livestock and wild ungulate grazing is prevalent throughout Region 3 National Forest lands and is thought to have a negative effect on the availability of grass cover for prey species. Recreation impacts are increasing on all forests, especially in meadow and riparian areas. There is anecdotal information which indicates that owls in heavily used recreation areas are much more erratic in their movement patterns and behavior. Fuels reduction treatments, though critical to reducing the risk of catastrophic wildfire, can have short-term adverse affects to Mexican spotted owl through habitat modification and disturbance. As the population grows, especially in Arizona, small communities within and adjacent to National Forest System lands are being developed. This trend may have detrimental effects to Mexican spotted owl by further fragmenting habitat and increasing disturbance during the breeding season. West Nile Virus also has the potential to adversely impact the Mexican spotted owl. The virus has been documented in Arizona, New Mexico, and Colorado, and preliminary information suggests that owls may be highly vulnerable to this disease. Unfortunately, due the secretive nature of owls and the lack of intensive monitoring of banded individual birds, we will most likely not know when owls contract the disease or the extent of its impact to Mexican spotted owls range-wide.

Currently, high intensity, stand-replacing fires are influencing ponderosa pine and mixed conifer forest types in Arizona and New Mexico. Mexican spotted owl habitat in the southwestern United States has been shaped over thousands of years by fire. Since Mexican spotted owl occupy a variety of habitats, the influence and role of fire has most likely varied throughout the owl's range. In 1994, at least 40,000 acres of nesting and roosting habitat were impacted to some degree by catastrophic fire in the Southwestern Region (Sheppard and Farsnsworth 1995). Between 1991 and 1996, the Forest Service estimated that approximately 50,000 acres of owl

habitat had undergone stand replacing wildfires (Sheppard and Farnsworth 1995). However, since 1996, fire has become catastrophic on a landscape scale and has resulted in hundreds of thousands of acres of habitat lost to stand-replacing fires. This is thought to be a result of unnatural fuel loadings, past grazing and timber practices, and a century of fire suppression efforts. The 2002 Rodeo-Chediski fire, at 462,384 acres, burned through approximately 55 PACs on the Tonto and Apache-Sitgreaves National Forests and the White Mountain Apache Reservation (within the Upper Gila Recovery Unit). Of the 11,986 acres of PAC habitat that burned on National Forest lands, approximately 55 percent burned at moderate to high severity. Based on the fire severity maps for the fire perimeter, tribal and private lands likely burned in a similar fashion. We define moderate severity burn as high scorch; trees burned may still have some needles and high severity burn as completely scorching all trees (trees completely dead).

The Basin and Range West RU encompasses a small portion of New Mexico and the majority of southern Arizona and is the second largest RU in the United States. The base of the Mogollon Rim defines the northern border of this RU. The western boundary defines the western extent of the Mexican spotted owl's range. Land ownership within this RU is a mosaic of public and private lands, with the Mexican spotted owl primarily occupying Forest Service lands. The Forest Service has designated 154 PACs on the Coronado, Tonto, Prescott, and Apache-Sitgreaves National Forests within the Basin and Range West RU.

The RU is characterized by numerous mountain ranges, which rise abruptly from the broad, plain-like valleys and basins. In southern Arizona, these mountain ranges are often referred to as the Sky Islands. Vegetation ranges from desert scrubland and semi-desert grassland in the valleys upwards to montane forests (chaparral and pine-oak woodlands at low and middle elevations and ponderosa pine, mixed-conifer, and spruce-fir forests at higher elevations). Within the Sky Islands, Mexican spotted owl habitat is characterized by woodland habitat, and territories occur in both heavily forested terrain and in areas with hardwood and conifer stringers dominated by Madrean evergreen woodland. In general, however, much of the Mexican spotted owl habitat occurs in forested, steep-slope canyons and drainages. The mature trees throughout much of the forest outside of these canyons and drainages have been partially or completely harvested.

The primary threats to Mexican spotted owl within this RU are catastrophic wildfire, recreation, and livestock grazing (USDI 1995). As in the Upper Gila Mountain RU, this area has experienced multiple wildfires that have influenced Mexican spotted owl habitat. The Clark Peak, Gibson Canyon, Miller, Noon, Rattlesnake, Shovel, Bullock, and Oversite fires burned at varying intensities throughout Mexican spotted owl PACs on the Coronado National Forest. The Four Peaks/Lone Fire was a catastrophic, high-intensity wildfire on the Tonto National Forest that burned through two Mexican spotted owl PACs. In 2003, there were two fires that burned at high-intensity across significant acreage that included Mexican spotted owl habitat. The Aspen Fire on the Coronado National Forest burned approximately 85,000 acres and partially burned nine Mexican spotted owl PACs, and the Helen's 2 Fire burned approximately 3,500 acres and impacted three Mexican spotted owl PACs within Saguaro National Park. The 2004 Nuttall Complex Fire in the Pinaleño Mountains burned approximately 29,725 acres and potentially impacted 20 PACs. However, a majority of the acreage in Mexican spotted owl habitat burned at moderate fire severity, and the long-term effects to Mexican spotted owl habitat are not known.

The Coronado, Tonto, and Prescott National Forests are used heavily for recreation, mainly due to their proximity to the large urban areas of Tucson and Phoenix. Riparian areas may provide important dispersal habitat between mountain ranges in this RU, so grazing in these areas is of concern due to potential negative impacts.

There are a total of 38 wildland urban interface projects in this RU. Nineteen of the proposed projects contain Mexican spotted owl PACs; 28 PACS within this project area will receive fuels reduction treatments. The Prescott National Forest is expecting to treat seven of the 15 known PACs on the forest. The WUI programmatic biological opinion states that only four of the PACs are expected to receive intensive treatments. Approximately 8,927 acres of protected habitat and 55,000 acres of restricted habitat occur within the proposed project area. No more than 2,000 acres of protected habitat are expected to be intensively treated, with the remainder of protected habitat treated per the recommendations in the Recovery Plan. The restricted habitat is all located within 0.5 mile of private land and will most likely receive fairly intensive treatments.

Since the owl was listed, we have completed or have in draft form a total of 157 formal consultations for the Mexican spotted owl. These formal consultations have identified incidences of anticipated incidental take of Mexican spotted owl in 361 PACs. The form of this incidental take is almost entirely harm or harassment. These consultations have primarily dealt with actions proposed by the Forest Service, Region 3. However, in addition to actions proposed by the Forest Service, Region 3, we have also reviewed the impacts of actions proposed by the Bureau of Indian Affairs, Department of Defense (including Air Force, Army, and Navy), Department of Energy, National Park Service, and Federal Highway Administration. These proposals have included timber sales, road construction, fire/ecosystem management projects (including prescribed natural and management ignited fires), livestock grazing, recreation activities, utility corridors, military and sightseeing overflights, and other activities. Only two of these projects (release of site-specific owl location information and existing forest plans) have resulted in biological opinions that the proposed action would likely jeopardize the continued existence of the Mexican spotted owl.

In 1996, we issued a biological opinion on Region 3 of the Forest Service's adoption of the Recovery Plan recommendations through an amendment to their Land and Resource Management Plans (LRMPs). In this non-jeopardy biological opinion, we anticipated that approximately 151 PACs would be affected by activities that would result in incidental take of Mexican spotted owls, with approximately 61 of those PACs located in the Basin and Range West RU. In addition, on January 17, 2003, we completed a reinitiation of the 1996 Forest Plan Amendments biological opinion, which anticipated the additional incidental take of five Mexican spotted owl PACs in Region 3 due to the rate of implementation of the grazing standards and guidelines, for a total of 156 PACs. Consultation on individual actions under these biological opinions resulted in the harm and harassment of approximately 243 PACs on Region 3 National Forest System Lands. Region 3 of the Forest Service reinitiated consultation on the LRMPs on April 8, 2004. On June 10, 2005, the FWS issued a revised biological opinion on the amended LRMPs. We anticipated that while the Region 3 Forests continue to operate under the existing LRMPs, take is reasonably certain to occur to an additional 10 percent of the known PACs on Forest Service lands. We expect that continued operation under the plans will result in harm to 49 PACs and harassment to another 49 PACs. To date, consultation on individual actions under the amended Forest Plans, as accounted for under the June 10, 2005, biological opinion has resulted in 14 PACs adversely affected (11 PACs harmed, 3 PACs harassed), with 9 of those PACs in the Basin and Range West RU and 5 in the Upper Gila Mountains RU.

Mexican Spotted Owl Critical Habitat

The final Mexican spotted owl critical habitat rule (USDI 2004) designated approximately 8.6 million acres of critical habitat in Arizona, Colorado, New Mexico, and Utah, mostly on Federal lands (USDI 2004). Within this larger area, proposed critical habitat is limited to areas that meet the definition of protected and restricted habitat, as described in the Recovery Plan. Protected habitat includes all known owl sites and all areas within mixed conifer or pine-oak habitat with slopes greater than 40 percent where timber harvest has not occurred in the past 20 years. Restricted habitat includes mixed conifer forest, pine-oak forest, and riparian areas outside of protected habitat.

The primary constituent elements for proposed Mexican spotted owl critical habitat were determined from studies of their habitat requirements and information provided in the Recovery Plan (FWS 1995). Since owl habitat can include both canyon and forested areas, primary constituent elements were identified in both areas. The primary constituent elements which occur for the Mexican spotted owl within mixed-conifer, pine-oak, and riparian forest types that provide for one or more of the Mexican spotted owl's habitat needs for nesting, roosting, foraging, and dispersing are in areas defined by the following features for forest structure and prey species habitat:

Primary constituent elements related to forest structure include:

- A range of tree species, including mixed conifer, pine-oak, and riparian forest types, composed of different tree sizes reflecting different ages of trees, 30 percent to 45 percent of which are large trees with dbh of 12 inches or more;
- A shade canopy created by the tree branches covering 40 percent or more of the ground; and,
- Large, dead trees (snags) with a dbh of at least 12 inches.

Primary constituent elements related to the maintenance of adequate prey species include:

- High volumes of fallen trees and other woody debris;
- A wide range of tree and plant species, including hardwoods; and
- Adequate levels of residual plant cover to maintain fruits and seeds, and allow plant regeneration.

The forest habitat attributes listed above usually are present with increasing forest age, but their occurrence may vary by location, past forest management practices or natural disturbance events, forest-type productivity, and plant succession. These characteristics may also be observed in younger stands, especially when the stands contain remnant large trees or patches of large trees. Certain forest management practices may also enhance tree growth and mature stand characteristics where the older, larger trees are allowed to persist.

There are 16 critical habitat units located in the Basin and Range West RU that contain approximately 1.2 million acres of designated critical habitat. The critical habitat units situated in the Huachuca Mountains are discussed in the Environmental Baseline section, below.

Environmental Baseline – Mexican Spotted Owl

The subset of the action area pertaining to the Mexican spotted owl includes all habitat (both nominal and designated critical) in the Huachuca Mountains that may be affected by the proposed action.

The Mexican spotted owl is resident in the Huachuca Mountains on Fort Huachuca and in surrounding Sierra Vista Ranger District and Coronado National Memorial lands above 6,500 feet. The Huachuca Mountains, including the portion encompassed by Fort Huachuca, are included in the Basin and Range-West RU, which is characterized by mountain ranges isolated by desert basins. This RU includes most of southern Arizona and a small portion of southwestern New Mexico. Owl territories within this RU occur in both heavily forested terrain and in areas with hardwood and conifer stringers dominated by Madrean Evergreen woodland.

Twenty-six Mexican spotted owl management territories, also called Protected Activity Centers (PACs) are known from the Huachuca Mountains, including one on National Park Service lands, ten within Fort Huachuca boundaries (two of which were newly designated in 2006) and fifteen on Coronado National Forest lands to the south of the Fort (Glenn Frederick, pers. comm. 2006 as cited in the Revised PBA). There are 21 PACs known from the Santa Catalina Mountains, 60 miles north-northwest of Fort Huachuca and 20 territories in the Santa Rita Mountains, 40 miles northwest of Fort Huachuca. Russell Duncan monitored, banded, and collected blood samples from Mexican spotted owls on Fort Huachuca from 1990 to 1999. Since 2000, the Fort has contracted with EEC for annual monitoring and inventory efforts on the installation. Results of all known Mexican spotted owl surveys on Fort Huachuca are reported in Table 10 in the Revised PBA (and reproduced below as Table 9). In 1996, SAIC conducted surveys of all suitable habitats on the South Range that did not contain previously identified spotted owl territories. These surveys, which followed the Mexican spotted owl Inventory Protocol published by the Forest Service Southwest Region (Forest Service 1996), did not identify any new breeding territories within the South Range. Potential spotted owl habitat (pine-oak woodlands and deciduous riparian woodlands) on the South Range comprised approximately 15.7 percent of the total area of the range.

Table 9, below, compares the reproductive success for each PAC. (Percent reproductive success determined by comparing the number of years with young produced compared to the number of years the PAC was occupied by a pair).

The percent reproductive success is based on years that the PAC was monitored, found to be occupied by a pair, and produced young. Some of the PACs have not been monitored every year, so their reproductive success percentage could vary from what has been calculated in Table 9.

Over the past 11 years of monitoring efforts, total occupancy for eight PACs ranged from as low as 25 percent to as high as 75 percent. Occupancy percentage was determined by dividing total number of subject areas by the total number of subject areas with confirmed or inferred occupancy. Reproductive output has ranged from as low as zero to as high as 66 percent over the

same period (EEC 2001d). Reproductive output was determined by dividing the total number of pairs inferred or confirmed by the total number of pairs confirmed with successful reproduction.

Seven PACs and two Inventory Areas (IAs) were monitored during Year 2001 efforts on Fort Huachuca with a 66 percent overall occupancy. There was successful reproduction of two out of the six confirmed or inferred pairs for a total of 33 percent reproductive output. One pair of Mexican spotted owl were observed nesting on Coronado National Forest lands adjacent to the installation and foraging on installation land while a second pair is believed to be foraging and protecting territory in Upper Scheelite Canyon but is actually a resident pair found in Brown Canyon on Coronado National Forest land (EEC 2001d).

Table 9: Mexican Spotted Owl Occupancy and Reproduction at Fort Huachuca PAC 1990-2005[1] (Adapted From Fort Huachuca Revised PBA)

PAC	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	Total Confirmed Young
Rock Springs Canyon Trail 5001001	ND	O, 1Y	O, 2Y	O, NN	O, NN	O, NN	O, 1Y	A	A	A	A	A	ND	1F	O, NU	O, NN	4
McClure Canyon 5001002	ND	O, 1Y	O, 3Y	O, NN	O, NN	O, NN	O, NF	O, 2Y	O, NN	O, NN	O, NU	1M, 1F	O, NU, (1Y[2])	O, NN	F	O, 1Y	8
Huachuca Canyon-Upper 5001003	ND	O, NU	O, 1Y	O, NN	O, NN	O, NN	O, NN	O, 2Y	O, 1Y	O, NN	O, 1Y	O, 2Y	1M	O, 1Y	O, NU	O, NN	8
Woodcutter Canyon 5001004	O, NN	A	O, NU	A	A	A	A	A	A	A	ND	ND	ND	ND	ND	O, 2Y	2
Scheelite Canyon 5001005	O, NN	O, 2Y	O, NN	O, NN	O, NN	O, 1M	O, NN+M	O, NN	O, NN	O, NN	O, NU	O, 2Y	1M	O, 1Y, 1U	O, 2Y	O, NF	7
Split Rock Canyon 5001006	ND	O, NF	O, NN	O, NN	O, NN	O, NN	M	A	A	A	A	A	ND	A	A	ND	0
Blacktail Canyon 5001007	ND	A	A	A	A	A	M	A	A	A	A	A	ND	ND	A	ND	0
Huachuca Canyon- Lower 5001008	ND	A	A	A	A	A	A	A	O, NU	A	O, 2Y	O, NN	O, 1Y	O, 2Y	F, NU	O, NF	5

[1] This table has been adapted from previous Mexican spotted owl annual monitoring reports provided to Fort Huachuca.

[2] One young observed post survey season (24 September 2002) an estimated 200 meters west of 2002 roost grove

LEGEND FOR TABLES 10 AND 12 (FROM USDA FOREST SERVICE, SOUTHWESTERN REGIONAL OFFICE REPORT DIRECTION, 1992.):

O: Pair occupancy inferred or confirmed

M: Male inferred or confirmed

F: Female inferred or confirmed

NN: Non-nesting

NU: Nesting status unknown

NF: Nest failed

Y: Number of young fledged

YD: Young found dead

NA: Nest abandoned

P: Presence of lone Mexican spotted owl, sex unknown

A: Absent or unoccupied

ND: No data

Table 10: Mexican Spotted Owl Reproductive Success Based on the Number of Years The PAC Was Occupied by a Pair, 1990 – 2005 (Adapted From Fort Huachuca Revised PBA)

Fort Huachuca, Cochise County, Arizona.				
PAC Name	**PAC Number**	**Years Young Produced**	**Years Occupied by a Pair**	**Average Percent Reproductive Success**
Rock Springs Canyon Trail	5001001	3	8	38%
McClure Canyon	5001002	5	14	36%
Huachuca Canyon Upper	5001003	6	14	43%
Woodcutter Canyon	5001004	1	3	33%
Lower Scheelite Canyon	5001005	4	15	26%
Split Rock Canyon	5001006	0	5	0%
Blacktail Canyon	5001007	0	0	0%
Huachuca Canyon Lower	5001008	3	6	50%

The FWS's policy is that potential nest/roost habitat is considered inadequately surveyed if more than one breeding season has elapsed since the last year of survey to protocol. The FWS considers inadequately surveyed habitat to be occupied by Mexican spotted owl. Follow-up surveys consisting of an additional year of survey (four visits) must occur prior to actions that may affect the owl or its habitat. Spotted owls have been detected at Fort Huachuca during winter in Tinker Canyon (Duncan *et. al.* 1993). However, no Mexican spotted owls were detected during the 2000 inventory efforts in this canyon. Owls may be found at lower elevation sites in the Huachuca Mountains when not nesting.

There are three IAs on Fort Huachuca in addition to the eight designated PACs (Table 11 here, Table 12 in the Revised PBA). IAs are potential foraging, nesting or roosting habitats. In the Basin and Range-West RU, owl management is based on PACs to ensure that all Mexican spotted owl sites known from 1989 through the life of the Recovery Plan are protected. PACs are areas of no less than 600 acres that enclose the best owl habitat in the area, with the nest or activity center near the center. There are 4,270 acres delineated as Mexican spotted owl PACs currently on Fort Huachuca. All eight PACs occur in the higher elevations of the Fort in the Huachuca Mountains. The Fort is currently outlining an Endangered Species Management Plan (ESMP) for this species and its habitat.

No potential spotted owl nesting, foraging, or wintering habitat is present on the East Range.

Table 1: Mexican spotted owl Occupancy and Reproduction in Inventory Areas on Fort Huachuca, 2000 – 2005

Inventory Area	2000	2001	2002	2003	2004	2005
Sawmill Canyon	O, + 1M	O, (?) Y[1]	ND	ND	ND	A[2]
Upper Scheelite Canyon	1M	O, NN	ND	O, 2Y	A	A
Upper Tinker Canyon [3]	A	ND	ND	ND	ND	ND

[1] Confirmed pair nested in Sunnyside PAC, Coronado National Forest. Nest success undetermined (P.T. Deecken, personal communication, 2001)
[2] Male detected once on Sawmill PAC side and once on Sunnyside PAC, never detected further into Sawmill Canyon
[3] Upper Tinker Canyon Inventory Area designated as unsuitable habitat for Mexican spotted owl (S. Stone, personal communication, 2001)

Status of the Species – Lesser Long-Nosed Bat

The lesser long-nosed bat was listed (originally, as *Leptonycteris sanborni*; Sanborn's long-nosed bat) as endangered in 1988 (FWS 1988). No critical habitat has been designated for this species. A recovery plan was completed in 1994 (FWS 1997e). Loss of roost and foraging habitat, as well as direct taking of individual bats during animal control programs, particularly in Mexico, have contributed to the current endangered status of the species. Recovery actions include roost monitoring, protection of roosts and foraging resources, and reducing existing and new threats.

Species Description

Cole and Wilson (2006) provided a species account for the lesser long-nosed bat, assigning the taxon full species status (*Leptonycteris yerbabuenae*). The lesser long-nosed bat is a medium-sized, leaf-nosed bat. It has a long muzzle and a long tongue, and is capable of hover flight. These features are adaptations for feeding on nectar from the flowers of columnar cacti (e.g., saguaro, *Carnegia gigantea*; cardon, *Pachycereus pringlei*; and organ pipe cactus, *Stenocereus thurberi*) and from paniculate agaves (e.g., Palmer's agave, *Agave palmeri*) (Hoffmeister 1986).

Distribution and Life History

The lesser long-nosed bat is migratory and found throughout its historical range, from southern Arizona and extreme southwestern New Mexico, through western Mexico, and south to El Salvador. It has been recorded in southern Arizona from the Picacho Mountains (Pinal County) southwest to the Agua Dulce Mountains (Pima County), southeast to the Peloncillo Mountains (Cochise County), and south to the international boundary. Roosts in Arizona are occupied from late April to September (Cockrum and Petryszyn 1991) and on occasion, as late as November (Sidner 2000); the lesser long-nosed bat has only rarely been recorded outside of this time period in Arizona (FWS 1997e, Hoffmeister 1986, Sidner and Houser 1990). In spring, adult females, most of which are pregnant, arrive in Arizona gathering into maternity colonies. These roosts are typically at low elevations near concentrations of flowering columnar cacti. After the young are weaned, these colonies disband in July and August; some females and young move to higher elevations, primarily in the southeastern parts of Arizona near concentrations of blooming paniculate agaves. Adult males typically occupy separate roosts forming bachelor colonies. Males are known mostly from the Chiricahua Mountains and recently the Galiuro Mountains (personal communication with Tim Snow, Arizona Game and Fish Department, 1999) but also

occur with adult females and young of the year at maternity sites (FWS 1997e). Throughout the night between foraging bouts both sexes will rest in temporary night roosts (Hoffmeister 1986).

Lesser long-nosed bats appear to be opportunistic foragers and extremely efficient fliers. They are known to fly long distances from roost sites to foraging sites. Night flights from maternity colonies to flowering columnar cacti have been documented in Arizona at 15 miles, and in Mexico at 25 miles and 36 miles (one way) (Dalton *et al.* 1994; personal communication with V. Dalton, 1997; personal communication with Y. Petryszyn, University of Arizona, 1997). Steidl (personal communication, 2001) found that typical one-way foraging distance for bats in southeastern Arizona is roughly 12.5 miles. A substantial portion of the lesser long-nosed bats at the Pinacate Cave in northwestern Sonora (a maternity colony) fly 25-31 miles each night to foraging areas in Organ Pipe Cactus National Monument (OPCNM) (FWS 1997e). Horner *et al.* (1990) found that lesser long-nosed bats commuted 30-36 miles round trip between an island maternity roost and the mainland in Sonora; the authors suggested these bats regularly flew at least 47 miles each night. Lesser long-nosed bats have been observed feeding at hummingbird feeders many miles from the closest known potential roost site (personal communication with Yar Petryszyn, University of Arizona, 1997).

Lesser long-nosed bats, which often forage in flocks, consume nectar and pollen of paniculate agave flowers and the nectar, pollen, and fruit produced by a variety of columnar cacti. Nectar of these cacti and agaves is high energy food. Concentrations of some food resources appear to be patchily distributed on the landscape and the nectar of each plant species used is only seasonally available. Cacti flowers and fruit are available during the spring and early summer; blooming agaves are available primarily from July through October. Columnar cacti occur in lower elevational areas of the Sonoran Desert region, and paniculate agaves are found primarily in higher elevation desert scrub areas, semi-desert grasslands and shrublands, and into the oak woodland (Gentry 1982). Lesser long-nosed bats are important pollinators for agave and cacti, and are important seed dispersers for some cacti.

Status and Threats

Recent information indicates that lesser long-nosed bat populations appear to be increasing or stable at most Arizona roost sites identified in the recovery plan (AGFD 2005, Tibbitts 2005, Wolf and Dalton 2005). Lesser long-nosed bat populations additionally appear to be increasing or stable at other roost sites in Arizona and Mexico not included for monitoring in the recovery plan (Sidner 2005). Less is known about lesser long-nosed bat numbers and roosts in New Mexico. Though lesser long-nosed bat populations appear to be doing well, many threats to their stability and recovery still exist, including excess harvesting of agaves in Mexico; collection and destruction of cacti in the U.S.; conversion of habitat for agricultural and livestock uses, including the introduction of bufflegrass, an exotic, invasive grass species; wood-cutting; drought; fires; human disturbance at roost sites; and urban development.

Approximately 20 – 25 large lesser long-nosed bat roost sites, including maternity and late-summer roosts, have been documented in Arizona (personal communication with Scott Richardson, FWS, 2006). Of these, 10 – 20 are monitored on an annual basis depending on available resources. Monitoring in Arizona in 2004 documented approximately 78,600 lesser long-nosed bats in late-summer roosts and approximately 34,600 in maternity roosts. Ten to 20 lesser long-nosed bat roost sites in Mexico are also monitored annually. Over 100,000 lesser

long-nosed bats are found at just one natural cave at Pinacate National Park, Sonora, Mexico (Cockrum and Petryszyn 1991). The numbers above indicate that although a relatively large number of lesser long-nosed bats exist, the relative number of known large roosts is quite small.

Maternity roosts, suitable day roosts, and concentrations of food plants are all critical resources for the lesser long-nosed bat. All of the factors that make roost sites useable have not yet been identified, but maternity roosts tend to be very warm and poorly ventilated (FWS 1997e). Human presence/disturbance at roosts is clearly an important factor as bats appear to be particularly sensitive to human disturbance at roost sites. For example, the illegal activity, presumably by immigrants or smugglers, at the Bluebird maternity roost site, caused bats to abandon the site in 2002, 2003, and 2005. The presence of alternate roost sites may be critical when this type of disturbance occurs.

The lesser long-nosed bat recovery plan (FWS 1997e) identifies the need to protect foraging areas and food plants such as columnar cacti and agaves. More information regarding the average size of foraging areas around roosts would be helpful to identify the minimum area around roosts that should be protected to maintain adequate forage resources

We have produced numerous biological opinions on the lesser long-nosed bat since it was listed as endangered in 1988, some of which anticipated incidental take. Incidental take has been in the form or direct mortality and injury, harm, and harass and has typically been only for a small number of individuals. Because incidental take of individual bats is difficult to detect, incidental take has often been quantified in terms of loss of forage resources, decreases in numbers of bats at roost sites, or increases in proposed action activities.

A few examples of more recent biological opinions that anticipated incidental take for lesser long-nosed bats are summarized below. The 2005 biological opinion for implementation of the Coronado National Forest Land and Resource Management Plan included incidental take in the form of harm or harass. The amount of take for individual bats was not quantified; instead take was to be considered exceeded if simultaneous August counts (at transitory roosts in Arizona, New Mexico, and Sonora) drop below 66,923 lesser long-nosed bats (the lowest number from 2001 – 2004 counts) for a period of two consecutive years as a result of the action. The 2004 biological opinion for the Bureau of Land Management Arizona Statewide Land Use Plan Amendment for Fire, Fuels, and Air Quality Management included incidental take in the form of harassment. The amount of incidental take was quantified in terms of loss of foraging resources, rather than loss of individual bats. The 2003 biological opinion for Marine Corps Air Station (MCAS) – Yuma Activities on the Barry M. Goldwater Range included incidental take in the form of direct mortality or injury (five bats every 10 years). Because take could not be monitored directly, it was to be considered exceeded if nocturnal low-level helicopter flights in certain areas on the BMGR increased significantly or if the numbers of bats in the Agua Dulce or Bluebird Mine roosts decreased significantly and MCAS-Yuma activities were an important cause of the decline. The 2002 biological opinion for Department of the Army Activities at and near Fort Huachuca (Fort), Arizona anticipated incidental take in the form of direct mortality or injury (six bats over the life of the project), harassment (20 bats per year), and harm (10 bats over the life of the project).

Environmental Baseline- Lesser Long-Nosed Bat

Three major maternity roosts and five major post-maternity roosts are known in Arizona. Post-maternity roosts are typically transitory roosts used by adults and/or young bats in summer or fall (Fleming 1995). Records of the lesser long-nosed bat at Fort Huachuca and areas within foraging distance of the Fort (~40 miles) include at least two large post-maternity roosts; observers have recorded over 15,000 lesser long-nosed bats at a mine in the Coronado National Memorial, approximately 10 miles from Fort Huachuca, and over 30,000 bats at Patagonia Cave, at a distance of approximately 20 miles from the Fort (McIntire 2006). Other records include: (1) Panama Mine near Pyeatt Ranch on the western boundary of Fort Huachuca; (2) Pyeatt Cave, Fort Huachuca; (3) Manila Mine, Fort Huachuca; (4) Woodcutters Canyon, Fort Huachuca; (5) Wren Bridge, Fort Huachuca; (6) Brown Canyon, Huachuca Mountains; (7) Canelo Mine eight miles west of Fort Huachuca; (8) Miller Canyon, Huachuca Mountains; (9) San Pedro RNCA at Fairbank; (10) Ramsey Canyon, Huachuca Mountains; (11) State of Texas Mine, Coronado National Memorial, Huachuca Mountains; (12) Cave of the Bells, Santa Rita Mountains; (13) Helvetia, Santa Rita Mountains; (14) Madera Canyon, Santa Rita Mountains; (15) Empire Ranch north of Sonoita; 16) several localities near Patagonia; and (17) Colossal Cave, Pima County (Cockrum and Petryszyn 1991, Fleming 1995, Sidner 1993, 1994). Of the above sites, Fleming (1995) considered the Patagonia Bat Cave, Manila Mine, State of Texas Mine, and the Cave of Bells to be major post-maternity roosts of the lesser long-nosed bat. Of the sites at Fort Huachuca, lesser long-nosed bats have been found day roosting at Pyeatt Cave and Manila Mine (some night roosting occurs at these sites as well). Wren Bridge is a night roost, and lesser long-nosed bats were mist-netted in Woodcutters Canyon (Sidner 1999, 1996, 1994). Upper Pyeatt Cave and Indecision Cave are considered potential day roosts, but the species has yet to be documented at these sites (Sidner 2005, 2000, 1999, 1996). A lesser long-nosed bat banded at Wren Bridge was found the next night at the Patagonia Bat Cave, demonstrating that individuals of this species move relatively long distances, and bats at Fort Huachuca are part of a larger regional population (Sidner 1996, Howell 1996).

Fort Huachuca is located within a portion of this species' range utilized as a migratory corridor during the southward seasonal movement. Semidesert grasslands and lower oak woodlands provide summer and early fall foraging habitat of paniculate agave. There are no records of parturient or lactating lesser long-nosed bats from the installation. Rather, occurrence coincides with post-maternity disbursal of juveniles and adult females. Feeding and mass gain is critical at this time for survival during migration (Sidner 1996). Prior to listing, little work was done on Fort Huachuca resulting in a paucity of historical occurrence data. Recent work, beginning in 1989 and continuing through 2005 resulted in the discovery and consistent monitoring of numerous day roosts, night roosts and potential roosts. Monitored sites include Manila Mine, Pyeatt Cave, Upper Pyeatt Cave, Indecision Cave and Wren Bridge (Sidner 2005). Manila Mine and Wren Bridge are important night roosts for varying numbers of lesser long-nosed bats, and Pyeatt Cave has been found to be used as a night roost as well.

Since 1990, Sidner has conducted surveys of six potential roost sites on Fort Huachuca and found that Manila Mine and Pyeatt Cave were used primarily as day roosts by lesser long-nosed bats as well as other bat species, that roost sites have been inhabited by bat colonies at least six months of the year, that there is variation in bat population numbers throughout this period, and that the population numbers have increased following the use of protective measures. These roosts are located on the West Range.

Annual peak numbers of lesser long-nosed bats counted at roosts on Fort Huachuca between 1990 and 2005 have varied from 24 in 1990 to approximately 14,043 in 2005 (Sidner 2005). Lesser long-nosed bats have been recorded at Fort Huachuca from late June through October and as late as November 26 (Sidner 2000), with numbers of bats typically peaking in early September (Sidner 1996). Howell (1996) suggests that there are many potential roost sites in the Huachuca Mountains where hundreds of nectar feeding bats could roost without being detected.

Sensitivity of roosting lesser long-nosed bats to human disturbance lead the Fort to close Manila Mine, Pyeatt Cave, and Upper Pyeatt Cave to entry from April 15 through October 31 of each year. Entrances to these caves/mine are fenced with chain link in a way that inhibits illegal human entry but does not interfere with bats entering or exiting the roosts. The caves/mine are also posted. The access roads to Manila Mine and Pyeatt Cave are gated and locked.

Lesser long-nosed bats require suitable forage plants. At and near Fort Huachuca, forage plants include Palmer's agave and possibly Parry's agave (the two are known to hybridize, as well.) Populations of Palmer's agave found on the South and West Ranges represent the primary food source for lesser long-nosed bats on Fort Huachuca (Howell and Robinett 1995). Several areas of agave stands on the South and West Ranges are protected and are known as agave management areas (Figure 31). These stands have relatively high densities of agave as compared with other populations across the installation.

There are no known mines or caves on the South Range with suitable roosting habitat for lesser long-nosed bats. Nighttime netting efforts conducted on the South Range (Lower Garden, Middle Garden, Upper Garden, Huachuca, Tinker and Woodcutters Canyons) by Sidner in 1993 and 1994 were successful in trapping one lesser long-nosed bat in Woodcutters Canyon in nine nights of trapping.

There is no known roosting habitat for lesser long-nosed bats on the East Range. Only a few agaves are present in the grasslands located in the northwestern corner of this range.

Status of the Species – Sonora Tiger Salamander

We listed the Sonora tiger salamander as endangered in a Federal Register Notice (62 FR 665), dated January 6, 1997, without critical habitat. The final recovery plan was signed in September 2002.

The Sonora tiger salamander is a large salamander with a dark venter and light-colored blotches, bars, or reticulation on a dark background. Snout-to-vent lengths of metamorphosed individuals vary from about 2.6 to 4.9 in (Jones *et al.* 1988, Lowe 1954). Larval salamanders are aquatic with plume-like gills and well-developed tail fins (Behler and King 1980). Larvae hatched in the spring are large enough to metamorphose into terrestrial salamanders from late July to early September, but only an estimated 17 to 40 percent metamorphose annually. Remaining larvae mature into branchiates (aquatic and larval-like, but sexually mature salamanders that remain in the breeding pond) or overwinter as larvae (Collins and Jones 1987; James Collins, Arizona State University, pers. comm. 1993 as cited in the Revised PBA).

The Sonora tiger salamander is known from about 53 breeding localities, although not all are currently occupied (FWS 2002c, Abbate 1998, Collins and Jones 1987, Collins 1996). During intensive surveys in 1997, from one to 150 Sonora tiger salamanders were found at 25 stock tanks (Abbate 1998). Populations and habitats are dynamic, so the number and location of extant aquatic populations change over time, as exhibited by the differences between survey results in 1985 and 1993 to 1996 (Collins and Jones 1987; Collins 1996; James Collins, pers. comm. 1996 as cited in the Revised PBA). In 1999, Dr. James Collins's laboratory crew (Arizona State University), found Sonora tiger salamanders at 17 localities (Collins 1996). All sites where Sonora tiger salamanders have been found are located in Arizona in the Santa Cruz and San Pedro river drainages, including sites in the San Rafael Valley and adjacent portions of the Patagonia and Huachuca mountains in Santa Cruz and Cochise counties. All confirmed historical and extant aquatic populations are found in livestock tanks or impounded cienegas within 19 miles of Lochiel, Arizona. A population of salamanders at Los Fresnos, a natural cienega in the San Rafael Valley, Sonora, may be *A. t. stebbinsi* (Varela-Romero *et al.* 1990).

Historically, Sonora tiger salamanders probably inhabited springs, cienegas, and possibly backwater pools of the Santa Cruz River and streams in the San Rafael Valley where permanent or nearly permanent water allowed survival of mature branchiates. The grassland community of the San Rafael Valley and adjacent montane slopes, where all extant populations of Sonora tiger salamander occur, may represent a relict grassland and a refugium for grassland species. Tiger salamanders in this area became isolated and, over time, genetically distinct from ancestral *A. t. mavortium* and *A. t. nebulosum* (Jones *et al.* 1995). The Sonora tiger salamander apparently has opportunistically taken advantage of available livestock tank habitats as natural habitats disappeared (Hendrickson and Minckley 1984), or were invaded by nonnative predators with which the salamander can not coexist (FWS 2002c).

Although most records for Sonora tiger salamanders occur at livestock tanks where breeding occurs, terrestrial metamorphic (metamorphs) forms may wander considerable distances from these aquatic ecosystems and are occasionally encountered in uplands. A Sonora tiger salamander was captured in a pit fall trap at Oak Spring in Copper Canyon, Huachuca Mountains, by AGFD personnel. The nearest known breeding site was about 0.6 mile to the south, suggesting the salamander may have moved at least that far. Capture in a pit fall trap also confirms that the individual was surface active. In other subspecies of *Ambystoma tigrinum*, metamorphs may disperse hundreds of meters from the breeding pond, or may remain nearby (Petranka 1998, Gehlbach *et al.* 1969). Of hundreds of marked *Ambystoma tigrinum nebulosum* in northern Arizona, two were found to move from 0.9 to 1.2 miles to new ponds (J. Collins, pers. comm. 1998 as cited in the Revised PBA). On Fort Huachuca, Sheridan Stone (pers. comm. 1998 as cited in the Revised PBA) reported finding terrestrial tiger salamanders (probably *A. t. mavortium*), from 1.9 to 2.5 miles from the nearest known breeding pond. Referring to conservation of the California tiger salamander, *A. californiense*, Petranka (1998) found, based on studies of movements of other *Ambystoma* species, conservation of a 650 to 1,650 ft radius of natural vegetation around a breeding pond would protect the habitat of most of the adult terrestrial population. Adults of western subspecies of *A. tigrinum* typically live in or around mammal burrows (Petranka 1998), although metamorphs may construct their own burrows, as well (Gruberg and Stirling 1972, Semlitsch 1983). Some species of salamanders exhibit seasonal migrations of up to several miles each way from breeding sites to upland habitats (Stebbins and Cohen 1995). If such migrations occur in the Sonora tiger salamander, we have no information about migration corridors or non-breeding habitat. Because of the arid nature of the

environments in the region where the subspecies occurs, if salamanders move very far from breeding ponds, they may use wet canyon bottoms as movement corridors.

Primary threats to the salamander include predation by nonnative fish and bullfrogs, diseases, catastrophic floods and drought, illegal collecting, introduction of other subspecies of salamanders that could genetically swamp *A. t. stebbinsi* populations, and stochastic extirpations or extinction characteristic of small populations. Predation by catfish, bass, mosquito fish, and sunfish can eliminate livestock tank populations of Sonora tiger salamander (Jonathan Snyder, Arizona State University, pers. comm. 1996 as cited in the Revised PBA; Collins *et al.* 1988). The salamanders can apparently coexist with bullfrogs, but bullfrogs prey on salamanders (J. Snyder, pers. comm. 1996 as cited in the Revised PBA) and, if they are present in sufficient densities, bullfrogs could reduce or eliminate salamander populations. Tadpoles of wood frogs (*Rana sylvatica*), are known to feed on spotted salamander (*Ambystoma maculatum*), eggs (Petranka *et al.* 1998), but under experimental conditions, bullfrog tadpoles do not feed on viable salamander eggs or hatchlings (Collins 1996, J. Collins, pers. comm. 1996 as cited in the Revised PBA). Recent genetic analysis confirmed that barred salamanders (*A. t. mavortium*) or hybrids between barred salamanders and Sonora tiger salamanders are present at seven livestock tanks in the southeastern portion of the San Rafael Valley (Ziemba *et al.* 1998). A salamander population in Garden Canyon, Fort Huachuca, near the crest of the Huachuca Mountains, may also contain hybrids (Storfer *et al.* 1999).

Tiger salamander populations in the western United States and Canada, including populations of the Sonora tiger salamander, exhibit frequent epizootics (Collins *et al.* 2001). Sonora tiger salamander populations experience frequent disease-related die-offs (about eight percent of populations are affected annually) in which almost all salamanders and larvae in the pond die. *Ambystoma tigrinum* virus (ATV) is the pathogen believed to be primarily responsible for these die-offs (Jancovich *et al.* 1998), as well as die-offs observed in other tiger salamander populations in the United States and Canada (Collins *et al.* 2000). It is also possible that some die-offs might occur as a result of low pH (M. Pruss, AGFD, pers. comm. as cited in the Revised PBA). A copper smelter at Cananea, Sonora, less than 25 miles south of the border, may have released sulfur plumes resulting in acid precipitation (Blanchard and Stromberg 1987), but currently there is no evidence to connect salamander die-offs with the copper smelter, and the smelter has not been operated since 1999. ATV may be spread by bullfrogs, birds, livestock, or other animals that move among tanks (Jancovich *et al.* 1998). The disease could also be spread by researchers or anglers if equipment such as waders, nets, or fishing tackle used at a salamander tank are not allowed to dry or are not disinfected before use at another tank.

Sonora tiger salamanders also contract chytridiomycosis, a fungal disease associated with global declines of frogs and toads (see the discussion in the Chiricahua leopard frog section) (Speare and Berger 2000, Loncore *et al.* 1999, Berger *et al.* 1998), but when compared to anurans, infected salamanders exhibit only minimal symptoms (Davidson *et al.* 2000). The effect of the disease on salamander populations needs further study.

With the exception of Bog Hole in the San Rafael Valley and a site on Fort Huachuca, livestock grazing occurs throughout the range of the Sonora tiger salamander. Livestock can degrade habitat at livestock tank breeding sites and overgrazing can cause loss of cover and erosion that can threaten the integrity of stock tanks used by the salamander. The salamander has coexisted for about 250 years with grazing, and because of its current use of livestock tanks for breeding, is

now dependent upon maintenance of livestock waters by ranchers (FWS 2000c). In regard to livestock management on the Forest, the final recovery plan calls for: (1) protection of vegetation communities and watershed values in the San Rafael Valley; (2) implementation of FWS guidelines for stock tank management and maintenance; (3) regular cleaning and maintenance of stock tanks; (4) enhancement of bankline and aquatic vegetation cover at stock ponds; and (5) minimize establishment of, and implement control of, nonnative aquatic predators in the San Rafael Valley.

For further information on the ecology, taxonomy, range, and threats to this subspecies, refer to Collins (1996), Collins and Jones (1987), Collins *et al.* (1988), Gehlbach (1967), Jancovich *et al.* (1998), Jones *et al.* (1995, 1988), Lowe (1954), Snyder *et al.* (1998, 1996), and FWS 2000c and 2002.

Environmental Baseline – Sonora Tiger Salamander

Three populations of Sonora tiger salamanders are known to exist in the Huachuca Mountains. These salamanders occur in Scotia and Copper canyons (outside of Fort Huachuca), and in Upper Garden Canyon (within Fort Huachuca). Tiger salamanders suspected of being Sonora tiger salamanders occurred in recent years at the lower Peterson Ranch tank in Scotia Canyon, which is within approximately one mile of Gate No. 7 and upper Garden Canyon Pond. The upper reaches of Scotia Canyon support perennial surface water and the canyon may be a movement corridor for salamanders to access higher elevation sites in the Huachuca Mountains from localities in and near the lower reaches of Scotia and Sunnyside canyons. Salamanders have not been observed at the lower Peterson Ranch tank in recent years; this population may be extirpated.

On Fort Huachuca, tiger salamanders are known from Upper Garden Canyon Pond near the crest of the Huachuca Mountains and the junction of Sawmill and Garden canyons, and they were also found in the wastewater treatment ponds and the golf course. Salamander populations in the wastewater treatment ponds were eradicated when those ponds were drained and reconfigured as infiltration ponds that have surface water only for brief periods of time. The Upper Garden Canyon Pond nearly went dry in the spring of 1996. Drought conditions in early 1996 severely diminished the volume of the tank, and surveys of this population in April 1996 detected only one branchiate salamander. The pond dried again in June 1997 (J. Collins pers. comm. 1998 as cited in the Revised PBA) and June 1999 (J. Rorabaugh, FWS, pers. obs. 1999 as cited in the Revised PBA). Since then visible larval salamander numbers have ranged from many hundreds in the early 2000s to none, depending on water and submergent vegetation conditions and time of day or year. No salamander metamorphs or larvae were seen in mid March 2003 at low water, and the pond dried that spring. However, in December 2003, several larvae approximately 4 inches long were visible in the shallow, ice skimmed water, indicating that salamander breeding had occurred after summer rains provided runoff to the pond. The pond was dry in the springs of 2005 and 2006 because of drought conditions. Periodic drying results in the elimination or metamorphosis of aquatic larval and branchiate salamanders. Reduced water levels stimulate metamorphosis, and many salamanders simply walk away from drying ponds and return to breed when the pond refills. However, if the pond remained dry for several seasons or for years, or water was not present long enough to allow breeding and metamorphosis, the number of surviving terrestrial salamanders might not be sufficient to re-colonize the pond. Re-colonization would then have to occur as a result of immigration from another pond.

In 1995, 1997, 1998, and 1999, salamanders were collected from the Upper Garden Canyon Pond and in 1998 from the wastewater treatment ponds (Storfer *et. al.* 1999). Mitochondrial DNA sequencing and allozyme analysis of salamanders from wastewater ponds indicate that these salamanders are *Ambystoma tigrinum mavortium*. Analysis of salamanders from Upper Garden Canyon pond was less clear. These animals showed a high level of heterozygosity, which is uncharacteristic of *A. t. stebbinsi*, but the mitochondrial DNA sequencing suggested these animals are identical to the majority of *stebbinsi* populations in the San Rafael Valley. A cannibalistic morph was also found at Upper Garden Canyon pond, which is highly unusual for *stebbinsi* populations, but a common occurrence in populations of *A. t. mavortium*. Further investigation using micro-satellite analysis and regional specimen samples documented and characterized evidence of genetic introgression between the two subspecies (Storfer *et al* 2004) and its geographic scope, including Upper Garden Canyon Pond.

Effects of the Proposed Action

The following narratives consists of an analysis of the effects of the proposed action for the Huachuca water umbel, southwestern willow flycatcher, Mexican spotted owl, lesser long-nosed bat, and Sonora tiger salamander. Following the respective analyses is a conclusion regarding our jeopardy analysis of the proposed action.

This biological opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.02 for this or any other species' effects analysis. Instead, we have relied upon the statute and the August 6, 2004, Ninth Circuit Court of Appeals decision in *Gifford Pinchot Task Force v. U.S. Fish and Wildlife Service* (No. 03-35279) to complete the respective critical habitat effect analyses.

The respective analyses are also accompanied by an Incidental Take Statement and, as appropriate, sections detailing the Amount of Extent of the Take, Effect of the Take, Reasonable and Prudent Measures, and Terms and Conditions. A Conservation Measures section is included for each species. A section detailing the Reporting Requirements/Disposition of Dead or Injured Listed Animals and a Reinitiation and Closing Statement appear after the Incidental Take Statement.

Effects of the Proposed Action - Huachuca Water Umbel

Effects to Huachuca water umbel and the species' critical habitat can be separated into two broad categories for analysis: (1) direct and indirect effects to plants occurring on and critical habitat designated within the post boundaries; and (2) indirect effects (including the effects of interdependent and interrelated actions) to plants and critical habitat on the San Pedro River within the San Pedro RNCA.

Huachuca water umbel population sites and critical habitat within the boundary of Fort Huachuca are affected directly and indirectly through actions that disturb land and vegetation. Huachuca water umbel population sites and critical habitat along the San Pedro River within the San Pedro RNCA are affected indirectly by Fort Huachuca's pumping of ground water from within the Sierra Vista Subwatershed. The following narrative contains separate analyses of on-post and off-post effects.

On-Post Effects

Table 13 in the Revised PBA portrays which elements of the proposed action are likely to adversely affect Huachuca water umbel and its critical habitat. Fort Huachuca has determined that fire and human disturbance are capable of adversely affecting the species. The specific mechanisms for these effects are described below.

Activities that may adversely affect Huachuca water umbel and/or its critical habitat on Fort Huachuca include recreational activities, vehicle use, maintenance of roads and firebreaks, military testing and training activities, fire ignited by authorized ordnance use or recreationists, and activities associated with prescribed fire or fire suppression. Military training and testing are limited in the canyons of the Huachuca Mountains where this species occurs, and vehicle use is restricted to existing roads and trails. A hiking trail passes by the Huachuca water umbel population site at Sawmill Spring. Limited trampling by recreationists likely occurs at this locality, but is not considered a serious threat to this population. The population at Upper Garden Canyon picnic ground is located in the picnic area and likely subject to trampling, but the Fort has placed large boulders around the area to prevent vehicles from driving through the species' habitat. Other populations in Garden and McClure canyons receive less use by recreationists, and trampling and damage by vehicles are less likely to occur in these areas. Fire could directly affect umbel should riparian corridors be burned, and umbel could suffer from excessive scouring erosion and subsequent deposition of ash and sediment were an appreciably large fire to occur within the watershed. It should also be noted that some lower level of post-fire disturbance could benefit the species through reduced competition and dispersal of patches.

A pipeline currently exists in Garden Canyon that has the potential to divert a portion of the flow in Garden Canyon for downstream use. The potential amount of such a diversion is unknown, but the source is eight springs, with the uppermost spring located near the pictograph sites. From this point, water could be collected and diverted in a pipeline from the various springs along Garden Canyon Creek (Tom Cochran, pers. comm. 1998 as cited in the Revised PBA). Fort Huachuca has removed all water uses from this pipeline. However, the pipeline infrastructure will remain intact and may be used in the future for mobilizing, emergencies, and fire fighting. These uses are expected to be infrequent and of short duration, and thus should have little effect on water umbel populations in Garden Canyon. The Fort has already implemented conservation measures to reduce the effect of human disturbance on the umbel populations and critical habitat. These include the protection of umbel populations with boulders and the closure of Gate 7, located near the headwaters of Garden Canyon.

There are 3.8 miles of Huachuca water umbel critical habitat in Garden Canyon on Fort Huachuca. Effects to this critical habitat unit are similar in scope to the effects to individual population sites as described above. The primary constituent elements of Huachuca water umbel critical habitat were described previously in the Status of the Species section and include perennial base flows; a stream channel subject to periodic, rejuvenating flooding; a stable, native species-dominated riparian community; and the presence of refugial sites for recolonization. Note that the proposed action's effects to the 33.7 miles of critical habitat on the San Pedro RNCA will be described in the Off-Post/San Pedro RNCA effects analysis, below.

Implementation of the proposed action is unlikely to permanently alter or diminish base or flood flows in Garden Canyon; the Fort Huachuca pumping centers are well downgradient of the canyon. No changes in the magnitude, frequency, or duration of flood flows are anticipated unless an appreciably large wildfire were to occur. In that event, we feel that the Huachuca water umbel would be able to persist in discreet sites, particularly within reaches containing deergrass (*Muhlenbergia rigens*), boulders, and other elements of hydraulic complexity that would tend to shelter individual umbel plants. The proposed action is unlikely to result in any changes to Garden Canyon's riparian species composition or remove any elements that would provide refuge during times of elevated flows.

Table 17 in the Revised PBA describes funding for monitoring of threatened and endangered species. It is our assumption that such monitoring will continue under extant methodologies, with opportunity for revision during annual coordination meetings.

Off-Post/San Pedro RNCA Effects

Huachuca water umbel population sites and critical habitat on the mainstem San Pedro River are affected indirectly by the pumping of water from the regional aquifer. Ground water is pumped: (1) by Fort Huachuca to serve its on base military and civilian population; (2) by municipal and investor-owned utilities to serve local industries and residents; and (3) by private land owners operating private wells and well shares. A portion of the water pumped under the latter constitutes an interrelated action; this will be described in greater detail, below.

Fort Huachuca's pumping (direct and interrelated) results in both removal of ground water from *storage* in the regional aquifer and the *capture* of water from discharge. Ground water in storage is that which resides in an aquifer. Such stored water may be discharging to a spring or waterway. Water used by plants through evapotranspiration is also categorized as discharge. Under unaffected conditions (i.e. no pumping), infiltration of rainfall and runoff maintains storage in equilibrium with discharge. Water withdrawn from the ground by wells initially derives exclusively from storage. As pumping continues, increasing proportions of water are derived from the capture of discharge, and decreasing proportions are derived from storage. In other words, ground water wells are withdrawing not only water residing in the aquifer, but also water that was otherwise destined to become the surface flow of a stream and/or be available to sustain riparian vegetation. If water withdrawal continues unmitigated, it will eventually deplete storage, reverse the flow direction of ground water, and capture (dewater) the stream itself. Deprivation of the base flow of the San Pedro River could eventually cause perennial reaches to become intermittent or ephemeral. Such a change in the hydrologic regime of the San Pedro River, depending upon the reach in which it occurred, could result in losses of numerous Huachuca water umbel population sites. The following narrative describes the magnitude of this potential effect, and Fort Huachuca's proposed measures to avoid and minimize it.

The Revised PBA (subsections 3.7.3 through 3.7.7) describes the volume of net aquifer storage change attributable to the presence of Fort Huachuca in the Sierra Vista Subwatershed. The ground water demand accounting method outlined in the Revised PBA involves an analysis of several key values: (1) the human population in the Sierra Vista Subwatershed attributable to Fort Huachuca; (2) the distribution of that population between urban and unincorporated (rural) areas of the subwatershed; (3) the average per capita water consumption rates for the Fort Huachuca/Sierra Vista area and the unincorporated areas of the subwatershed; (4) the average

percentage of ground water pumped that is derived from aquifer storage versus capture, as described previously; and (5) the amount of recharged effluent and storm water, which serves to offset the effects of pumping. Fort Huachuca's conservation easements that reduce ground water pumping near the river are not accounted for in the storage change calculations; rather, they are credited with reductions in capture.

From these key values the current net aquifer storage change in the Sierra Vista Subwatershed attributable to Fort Huachuca is determined as follows:

- Ground water use by the urban-area population attributable to the Fort is determined by multiplying that number of people by an urban-area per capita ground water demand of 160 gallons per day.

- Ground water use by the population attributable to the Fort who live in unincorporated areas of the subwatershed is determined by multiplying that number of people by an unincorporated-area per capita ground water demand of 118 gallons [0.132 acre-feet/per day (AFD) (GUAC, 2006)].

- Net ground water use attributable to the Fort is calculated by subtracting artificial/incidental recharge attributable to the Fort from the total ground water use attributable to the Fort.

- Pumping-induced ground water storage change attributable to Fort Huachuca is calculated by multiplying the Fort's net ground water use by the percentage of ground water that comes from storage (55 percent). The remainder, 45 percent, of pumping is from the capture of natural discharge (Goode and Maddock, 2000; Corell, *et al*, 1996; Freethey 1982; Vionnet 1992).

- Natural discharge in the Sierra Vista Subwatershed is divided between riparian ET (64 percent) and stream discharge (36 percent). The reduction in natural stream discharge, in terms of annual volume, can then be converted to instantaneous base flows in the San Pedro River.

- Fort Huachuca's net effect to base ground water pumping in 2005, therefore, could result in a 0.3 CFS base flow reduction, the timing and location of which cannot currently be predicted. The magnitude of this impact is anticipated to be reduced to a 0.04 CFS reduction in base flows through water conservation measures implemented by 2016. These calculations appear in Table 12 and the accompanying narrative, below.

Appendix K, and Tables 2 and 2a in the Revised PBA present the values used in calculating the ground water storage change attributable to Fort Huachuca in 2005 based on a subwatershed population attributable to the Fort of 32,179. Section 3 of the Revised PBA states that there were 75,337 people residing in the Sierra Vista Subwatershed in 2005. The Economic Income Forecasting System (EIFS) model was utilized to determine that of this total population in the Sierra Vista Subwatershed, 32,179 people are related to Fort Huachuca as direct, indirect, interrelated and interdependent population. This includes 25,398 military, civilian employees, contractors, military retirees, survivors and family members. It also includes 6,781 induced employees and their family members, i.e., their off post groundwater pumping would not occur

"but for" the presence of the Fort. It must be noted that the EIFS model has a firm basis in regional economic theory and is widely applied by the Department of the Army within the context of National Environmental Policy Act (NEPA) analyses to determine the economic impacts of changes in personnel levels (Appendix G of the Revised PBA).

Another calculation of the population attributable to Fort Huachuca was done by Robert Carreira from the Center for Economic Research (Appendix I in the Revised PBA). He determined that a population of 18,543 is attributable to the presence of Fort Huachuca. The FWS does not agree with the methodology used to derive the 18,543-person population, as it improperly excludes the indirect effects of residents who would not reside in the subwatershed but for the presence of Fort Huachuca. The Revised PBA contains analyses of the effects of both populations. The analysis of total ground water storage change attributable to Fort Huachuca in this biological opinion, however employs only the Fort Huachuca-attributable, EIFS-modeled population of 32,179 persons. Fort Huachuca is aware of and has concurred with our use of the 32,179-person population estimate for the effects analyses in this biological opinion (Robert Bridges, pers. comm. 2007).

The eventual ground water demand and storage change attributable to the Fort based on implementation of the proposed action in 2016 is estimated by consideration of the Fort's proposed mitigation strategy including: (1) conservation measures totaling 116 AFA of reduced pumping and 836 AFA of increased artificial recharge on post by 2016; and (2) conservation easements purchased by the Fort that eliminate 1073 AFA of pumping near the San Pedro River. Ground water pumped near the river derives mostly from capture rather than ground water storage. Thus, elimination of this pumping has a much greater potential for profound and immediate impact on stream flows and riparian evapotranspiration than any mitigative measures implemented appreciable distances from the San Pedro River.

Since Fort Huachuca and Sierra Vista use no surface water, and agricultural water use in the Sierra Vista Subwatershed is not likely attributable to the presence of Fort Huachuca, ground water use attributable to the Fort's population is determined on the basis of average municipal per capita water use for those living in urban areas, and average unincorporated area per capita water use for those living outside of urban areas, as well as a fraction of total industrial ground water demand in the subwatershed. Average per capita water demand for the Sierra Vista/Fort Huachuca area was calculated based on the combined 2005 resident population on the Fort (6,911) and Sierra Vista (34,694) divided by combined pumping from both entities. Pumping in 2005 at Fort Huachuca and in Sierra Vista was 1,403 AF and 6,058 AF, respectively, for a total of 7,461 AF. The resulting per capita water use rate for urban residents was 160 gallons per capita per day (gpcd). This value is slightly lower than the 2000 municipal per capita water use value of 164 gpcd for Sierra Vista Subwatershed published by ADWR (2005), reflecting conservation measures to reduce pumping since that time.

For residents of unincorporated areas of the subwatershed, an average water use rate of 118 gpcd was used. This value was estimated by the Groundwater Users Advisory Council of the Prescott Active Management Area (GUAC) (2006) for domestic well demand. Both the Fort's direct off-post population and the induced population were distributed between urban and unincorporated areas of the subwatershed according to the distribution representative of the whole subwatershed. Within the Sierra Vista Subwatershed, 31 percent of the population lives in unincorporated areas (AZDES, 2006). Of the Fort's total direct population of 25,398 in 2005, 18,487 persons resided

off-post, and 31 percent of those (5,820) were assumed to live in unincorporated areas of the subwatershed. Similarly, among the Fort's 2005 induced population of 6,781, 31 percent (2,135) are assumed to live outside urban areas, bringing the total unincorporated area population attributable to Fort Huachuca to 7,955 (5,820 + 2,135). The total urban-area population attributable to the Fort in 2005, including an induced urban population of 4,616, is estimated at 24,225 (19,578 + 4,646).

Fort Huachuca's total gross ground water demand within the Sierra Vista Subwatershed is derived by applying the urban-area total ground water demand of 160 gpcd to the urban-area population attributable to the Fort, applying the unincorporated-area domestic demand of 118 gpcd to the unincorporated-area population attributable to the Fort, and adding a fraction of the total subwatershed's industrial ground water demand. Including the induced population, the Fort was responsible for approximately 43 percent of the total 2005 population of the Sierra Vista Subwatershed. Therefore, the Fort's share of industrial ground water demand in 2005 is estimated as 43 percent of the total industrial demand in the subwatershed. ADWR (2005) estimated that 1,250 AF were required for sand and gravel operations and industrial golf course irrigation in the Sierra Vista Subwatershed in 2005, which puts Fort Huachuca's industrial ground water demand responsibility at 534 AF. Combining industrial demand (534 AF) with urban-area demand (4,344 AF) and unincorporated-area demand (1,050 AF) yields a total ground water demand of 5,928 AF in the Sierra Vista Subwatershed attributable to Fort Huachuca in 2005.

Human-induced recharge of water to the regional aquifer occurs from effluent recharge basins and storm water detention facilities, incidental storm water recharge in urban areas, and incidental recharge from turf grass irrigation, septic systems, and effluent discharged other than in basins. Only 5 percent of Sierra Vista is unsewered (ADWR, 2005), so septic system recharge in the city is very small. Total human-induced recharge except for septic systems in 2005 is estimated at 475 and 2,897 AFA for Fort Huachuca and Sierra Vista, respectively (see Appendix K in the Revised PBA, Table 2). The portion of Sierra Vista's human-induced recharge attributable to Fort Huachuca is based on the ratio of the Fort's off-post urban-area population (17,313) to the total Sierra Vista population (34,694) (Appendix G, Revised PBA). This fraction, 50 percent, of Sierra Vista recharge equals 1,446 AF, giving a total recharge "credit" of 1,921 (475 + 1,446) AF to Fort Huachuca in 2005 not including septic system recharge.

Septic systems are generally credited for contributing to ground water recharge, although no definitive values for septic recharge were found in the literature. ADWR (2005) assumes that all indoor water use (estimated at 69 gpcd) is recharged. This assumption fails to account for any ET losses of leach field water. The USPP has adopted a septic recharge rate of 70 percent (K. Lansey, 2006, pers. comm. as cited in the Revised PBA). Assuming an average per-capita indoor water use of 69 gpcd, then applying this recharge rate to the 5 percent of Sierra Vista homes that are unsewered (ADWR 2005) and to all of the unincorporated-area population in the Sierra Vista Subwatershed (assumed to be entirely served by septic systems) and then reducing those values to account only for the population attributable to Fort Huachuca yields a septic recharge "credit" of about 477 AF in 2005 for Fort Huachuca. Approximately 430 of those AF are recharged in unincorporated areas of the subwatershed (see Table 2 in Appendix K of the Revised PBA).

Total recharge credited to Fort Huachuca in 2005 is estimated at 2,398 (1,921 + 477) AF. This recharge "credit" is deducted directly from total gross ground water demand attributable to the Fort to determine the Fort's net ground water demand of 3,530 AF in 2005.

As discussed previously, pumped ground water derives either from ground water storage or capture of water from basin recharge or discharge. In the case of the Fort Huachuca/Sierra Vista pumping center, some of the ground water pumping captures water that would otherwise discharge to the Babocomari or San Pedro rivers or be consumed through ET. The only way to estimate the proportion of ground water extracted from storage versus capture is with a basin-wide hydrologic model. Several modeling studies provide estimates of this partitioning. Goode and Maddock (2000) state that by 1997, 65 percent of all ground water pumped from the upper San Pedro watershed came from aquifer storage. Modeling by Freethey (1982), Corell, *et al* (1996), and Vionnet (1992) estimated that56 percent, 51 percent, and 48 percent of pumping, respectively, was derived from aquifer storage. Based on an average of these published values, roughly 55 percent of water pumped from the regional aquifer in the Sierra Vista Subwatershed is derived from aquifer storage. Using this value, the total aquifer storage change from pumping attributable to Fort Huachuca is estimated to be 1,942 (0.55 * 3,530) AF in 2005.

Fort Huachuca has also calculated estimated water demands in 2016, the ten-year horizon for the proposed action; these values are contained in Table 12.5 in the Revised PBA (which appears in a revised form here as Table 12, below). Table 12.5 summarizes ground water demand and estimated potential impacts to natural discharge that may be attributed to the presence of Fort Huachuca in the Sierra Vista Subwatershed. The information in Table 12.5 is, in turn, derived from Appendix K, Tables 2 and 2a, and Appendix H in the Revised PBA. Table 12.5 includes a range of ground water demand estimates, and resulting impacts to natural discharge, based on two different estimates of the total portion of the population of the Sierra Vista Subwatershed that is attributable to Fort Huachuca (18,543 and 32,179 individuals). As stated above, this biological opinion will be based on an analysis of the 32,179-person population value, as it more accurately reflects Fort Huachuca's total population in the subwatershed.

Table 12 - Adaptation of Table 12.5 from the Revised PBA: Fort Huachuca's estimated range of impacts on natural discharge. Note that Table 12.5 in the Revised PBA considers a range of water yield and discharge values based on differing population estimates. FWS has only considered the greater values, as they were based on more accurate population estimates.

A	B	C	D	E	F	G	H
Year	Gross ground water demand (AFA)	Net (with recharge, without easements) ground water demand (AFA)	Change in storage (AFA) (55% storage-derived fraction of Column C)	Change in natural discharge without easements (AFA) (45% capture-derived fraction of Column C)	Change in natural discharge with easements (AFA)	Change in ET (AFA) (64% ET-derived fraction of Column F)	Change in baseflow (36% stream discharge fraction of Column F, converted to CFS)
2005	5,928	3,530	1,942	1,589	516	330	0.3
2016	5,812	2,578	1,418	1,160	87	56	0.04

Given a 32,179-person population, and using the accounting methodology detailed above, Fort Huachuca's total gross ground water demand (excluding attributable recharge) in 2005 was 5,928 AFA. The estimated total gross ground water demand that will exist in 2016, the planning

horizon for the proposed action, is 5,812 AFA (see column A of Table 12, above, or column 1 of Table 12.5 in the Revised PBA). Net ground water demand takes into consideration recharge attributable to Fort Huachuca that is occurring on and off-post. As stated previously, the net ground water demand in 2005 is 3,530 AFA. Considering the planned additional recharge beyond 2005 (but before 2016), the predicted net demand in 2016 will be 2,578 AFA (also shown in column 2 of Table 12, above, or Table 12.5 in the Revised PBA). These water demand values can be used to estimate Fort Huachuca's potential impact on aquifer storage and natural discharge, and also represent the current (and future) baseline water use deficits resulting from implementation of the proposed action.

As previously stated, roughly 55 percent of Fort Huachuca's ground water pumping is currently derived from aquifer storage; the remainder is derived from the capture of natural discharge. This ratio between ground water derived from capture versus that derived from storage can be used to estimate Fort Huachuca's net impact on aquifer storage and natural discharge, assuming the ratio between the percentages of water derived from storage versus capture do not change appreciably over the next decade. Aquifer storage change attributable to Fort Huachuca was 1,942 AFA in 2005 (55 percent of the 3,530 AFA 2005 ground water demand), and is estimated to be 1,418 AFA in 2016 (55 percent of the estimated 2,578 AFA 2016 demand).

Table 12 (here) and Table 12.5 (Revised PBA) show the estimated impact to capture without consideration of conservation easements purchased by Fort Huachuca. These figures, 1,589 AFA derived from of capture based on the proposed action as it existed at the 2005 baseline, and 1,160 AFA of capture that will occur based on the proposed action as it will exist in 2016, were derived by multiplying the net ground water demands (3,530 AFA in 2005 and 2,578 AFA in 2016) by 45 percent (the estimated percentage of pumping derived from capture).

Fort Huachuca's retirement of 1,073 AFA of agricultural pumping through the purchase of conservation easements is deducted from column 4 in Table 12.5 of the Revised PBA (Column F in Table 12, above) to determine the net impact on natural discharge. The close proximity of agricultural pumping to the San Pedro River means that most of the ground water from this source would have been derived from the capture of natural discharge, rather than from ground water storage.

Therefore, this retired pumping would have minimized approximately 1,073 AFA of impacts to natural discharge. This minimization would have therefore resulted in an eventual 516 AFA change in ground-water demand based on a 2005 baseline and an eventual 87 AFA change based on implementation of the proposed action in 2016 (see Column F of Table 12, above. The negative numbers in the fifth column of the original Table 12.5 in the Revised PBA reflect a potential increase in discharge at some indeterminate time in the future. These increases, however, occur only under a population scenario the FWS has determined to be inaccurate.

In order to convert this estimated impact on natural discharge to a potential impact on baseflow in the San Pedro River, the partitioning of ground water capture between the two natural sources of discharge, riparian ET and baseflow, must be estimated. Of the total natural discharge of 14,010 AFA, ground water-derived ET consumes a maximum of 9,010 AFA of ground water between the international border and the Tombstone gage (Leenhouts *et al.* 2006). Baseflow accounts for approximately 5,000 AFA of natural discharge upstream of the Babocomari River (see Sect. 3.6.3.2 of the Revised PBA). Therefore, ground water-derived ET then accounts for

64 percent and stream discharge for 36 percent of the total, observed natural discharge. Using this information, the change in natural discharge components can be estimated. ET changes, shown in Column G of Table 12, above, are 330 AFA based on 2005 ground water demand and 56 AFA based on 2016 ground water demand, whereas baseflow changes, shown in the eighth column and expressed in cubic feet per second (CFS), are 0.3 cfs based on 2005 ground water demand and 0.04 cfs based on 2016 ground water demand. Negative numbers, equating with a positive impact (accretion of flow), appear in Table 12.5 in the Revised PBA but are the result of an inaccurate population estimate not considered by the FWS.

The residual ground water storage deficits, and eventual reduction in base flow predicted from ground water demand in the target year 2016 can be expected to affect the base flow hydrology of the San Pedro River at some point in the future beyond 2016. The estimated magnitude of the impacts represents a worst-case scenario since it assumes that all baseflow is derived from the discharge of ground water from the regional aquifer, a situation that is known to be incorrect based on radioisotope and studies cited in the PBA (Pool and Coes 1999, Baillie 2005, Wahi 2005). These studies suggest appreciable baseflow contributions from rainfall and overbank flood events; sources of water not considered in the calculations appearing in Table 12.

Huachuca water umbel occupies a biohydrological niche which places it in the "hydric herbaceous perennial" vegetation class from Leenhouts *et al.* (2006). Hydric herbaceous perennial plants include smooth scouring rush (*Equisetum laevigatum*), hardstem bulrush (*Schoenoplectus acutus*), and Torrey rush (*Juncus torreyi*); all wetland obligates (Mohlenbrock 1992.). Leenhouts *et al.* (2006) found that cover of hydric perennial herbs declined with increasing elevation above the channel bed, a variable correlated with depth to ground water and inundation frequency. It can therefore be expected that continuing capture of ground water will affect habitat for Huachuca water umbel. The magnitude of these impacts, however, is relatively small.

The estimated changes in baseflow attributable to Fort Huachuca (0.3 CFS from ground water demand in 2005 and 0.04 CFS from ground water demand in 2016) are measurable and thus constitute an adverse effect on Huachuca water umbel. They are, however, small in magnitude and should be compared to the average annual baseflow in the San Pedro River. As previously noted, the average annual baseflow at the Tombstone gage is 5,000 AFA or 6.9 CFS year-round. Therefore, Fort Huachuca's maximum impacts to baseflow from ground water demand in 2005 represent approximately 4 percent of the average annual baseflow at the Tombstone gage. Fort Huachuca's maximum impacts are predicted to decrease to 0.6 percent of the average annual baseflow at the Tombstone gage as a result of proposed mitigation projects. Thomas and Pool (2006) indicate that baseflow changes on the order of 3,600 AFA (5 CFS) can occur as a result of natural climate and/or vegetation changes. Thus, the maximum predicted impact of pumping attributable to Fort Huachuca on baseflow is well within the range of natural variation.

Moreover, the small magnitude of these changes may approach the variability that exists in the hydraulic control which determines the accuracy of the stream gage. The stream gage located on the San Pedro River near Tombstone, for instance, is rated "good" by the U.S. Geological Survey, indicating that 95 percent of the site's published daily discharge values are within 10 percent of the actual value (Fisk *et al.* 2006). The next gage upstream, near Charleston, is rated as "fair", indicating that 95 percent of its stated daily discharges are within 15 percent of the actual values. The stream gage on the San Pedro River near Palominas is rated as "good". It is

not known if the 5 percent of the published values that are greater than 10 and 15 percent of the actual values, respectively, occur at very high or very low river stages.

It must be noted, however, that Fort Huachuca's hydrologic analysis did not consider the temporal nor spatial aspects of pumping attributable to the installation. The impacts from pumping at Fort Huachuca would likely be distributed downstream of the Charleston stream gage and are likely to be reflected in measurements of stream flow at the Tombstone stream gage at some indeterminate point of time in the future. This reach of the San Pedro River has historically been intermittent and thus, the modest base flow losses described above may actually be impossible to detect. Trends in stream flow for these mid to lower reaches of the San Pedro River within the Sierra Vista Subwatershed are discussed in Section 3.6.3.2 of the Revised PBA. Regarding the dispersed nature of off-post pumping attributable to the presence of Fort Huachuca (i.e., some of the pumping was from domestic wells in rural parts of the subwatershed and some from incorporated areas), it is difficult to predict the exact reaches where the effects of this pumping would manifest as impacts to baseflow and/or ET. Regardless, we do not feel that these small-in-magnitude alterations in the hydrology of the San Pedro River will result in appreciable reductions in the population size or geographic extent of Huachuca water umbel within the San Pedro River. Moreover, some Huachuca water umbel sites are located upstream from Charleston. These sites may be relatively unaffected by changes in baseflow and could serve as source populations for recolonization of downstream reaches.

Although the effects of ground water pumping in the Sierra Vista Subwatershed on Huachuca water umbel populations in the San Pedro RNCA are uncertain, recent studies suggest that currently these effects are small, and may not be attributed to human ground water uses. Recent studies suggest that declines in baseflow of the San Pedro River are due to drought and increased evapotranspiration (Thomas and Pool, 2006) and that baseflows in the San Pedro River are composed of 0 to 55 percent regional ground water and 45 to 100 percent monsoon floodwater, depending on variation in precipitation and whether or not the stream reach was gaining or losing (Baille 2005). Further, as discussed above, Fort Huachuca's effects to baseflow are expected to be reduced in magnitude over time.

There are 33.7 miles of critical habitat on the San Pedro RNCA. The primary constituent elements of Huachuca water umbel critical habitat were described previously in the Status of the Species section and include perennial base flows, a stream channel subject to periodic, rejuvenating flooding, a stable, native species-dominated riparian community, and the presence of refugial sites for recolonization. The analysis of the proposed action's effects to Huachuca water umbel critical habitat is based on the same review of hydrologic impacts and minimization measures described above.

We note that the proposed action is resulting and will continue to result in impacts to the first primary constituent element: base flows. The estimated maximum potential diminishment of base flows do affect the availability of perennial water for Huachuca water umbel, but the reduction in discharge is within the range of natural hydrologic variation as well as the measurement error of the hydrologic instrumentation. The residual effects to base flows will not alter flood-flow hydrology which serves as an important source of alluvial aquifer recharge as well as a mechanism by which the in-channel vegetation is kept in an early successional state that favors umbel. Lastly, Fort Huachuca's impacts to ground and surface water hydrology are not anticipated to result in the loss of refugial sites for Huachuca water umbel; we anticipate that

colonization of the San Pedro River will continue to occur from upstream sites in Sonora as well as from within the northeastern canyons of the Huachuca Mountains.

The proposed action is not anticipated to alter the magnitude, frequency, timing, or duration of flood flows (Primary Constituent Element 2) on Fort Huachuca or in the San Pedro RNCA. It must be noted that flood flows affect Primary Constituent Element 1 in that overbank flood events result in appreciable alluvial aquifer recharge. The proposed action is also not anticipated to appreciably alter riparian plant communities in which Huachuca water umbel occurs (Primary Constituent Element 2) or remove refugial sites Primary Constituent Element 4).

Cumulative Effects

Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Section 321 of the Defense Authorization Act of 2004 (Public Law 108-136) describes the manner in which section 7 of the Act is to be applied during interagency consultation with Fort Huachuca. Specifically, Section 321 states "For purposes of section 7 of the Endangered Species Act of 1973 (16 U.S.C. 1536), concerning any present and future Federal agency action at Fort Huachuca, Arizona, water consumption by State, local, and private entities off of the installation that is not a direct or indirect effect of the agency action or an effect of other actions that are interrelated or interdependent with that agency action, shall not be considered in determining whether such agency action is likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of designated critical habitat". Therefore, while there will be cumulative effects analyses for each species subject to formal consultation in the biological opinion, those cumulative effects will not be considered in our conclusions. For example, the pumping of ground water from the Sierra Vista Subwatershed by and for individuals whose presence is not related to Fort Huachuca or another Federal entity is an appreciable and adverse cumulative effect, but it cannot be considered when determining if the proposed action will jeopardize the continued existence of obligate aquatic or riparian species such as the Huachuca water umbel and southwestern willow flycatcher or destroy or adversely modify critical habitat.

Within the Sierra Vista Subwatershed, the cumulative effect with the greatest potential to affect the Huachuca water umbel is the withdrawal of ground water by entities other than Fort Huachuca and the installation's induced population. In the Description of the Proposed Action and Description of the Proposed Conservation Measures sections, above, Fort Huachuca describes the manner in which impacts to ground water storage and capture will be appreciably reduced, if not eliminated, by no later than 2016.

Our August 23, 2002, biological opinion considered a proposed action wherein Fort Huachuca calculated its total on-post and associated local population to determine the percentage of the total human population of the Sierra Vista Subwatershed. Of the 64,655 people residing in the Sierra Vista Subwatershed at that time, 34,993 (or 54 percent) of them would not have been there but for the presence of Fort Huachuca. The 54 percent value was then multiplied by the 5,144

AF ground water deficit known at that time; the Fort was thus responsible for offsetting a 2,784 AF ground water deficit.

Fort Huachuca no longer uses a population percentage-based calculation to determine its contribution to a regional ground water deficit. The Fort instead has sought to empirically determine the total ground water use by the installation and its induced population (see Table 12 in Off-Post/San Pedro RNCA Effects subsection of the Effects of the Proposed Action - Huachuca Water Umbel section, above). The revised, total water use methodology results in Fort Huachuca having a net change in natural discharge of 516 AF from 2005 net ground water demand, reduced to 87 AF from 2016 net ground water demand.

Fort Huachuca has proposed, with both currently funded and projected water conservation actions, to reduce the ground water pumping associated with its on- and off-post personnel regardless of population percentage, a value that will not be affected by decreased, calculated discharges due to increases in riparian ET or regional population growth proceeding at a rate greater than that associated with the installation. The "zeroing-out" of a portion of a fixed percentage of a frequently revised regional ground water deficit will thus no longer be a performance standard for Fort Huachuca. The regional ground water deficit, however, remains in place and continues to be affected by non-Federal actions that are cumulative to Fort Huachuca's proposed action. See Subsections 3.7.3 through 3.7.7 of the Revised PBA and the Off-Post/San Pedro RNCA and Cumulative Effects portions of the Huachuca water umbel effects analysis, above, for details regarding this revised methodology.

The most-current, published version of the U.S. Geological Survey's *Water Management of the Region Aquifer in the Sierra Vista Subwatershed, Arizona—2005 Report to Congress* (321 Report: USDI 2006) states that the estimated aquifer storage change in the Sierra Vista Subwatershed was -3,500 AF. There was thus 3,500 more AF of ground water being withdrawn and discharged than there was infiltrating and being recharged. The 2006 version of the 321 Report - currently in preparation – will employ a revised estimate of ground water consumed in the riparian system exclusive of evapotranspiration supplied by near-riparian recharge from precipitation or flood runoff. In 2005, the ground water consumption by the riparian system was estimated to be 7,700 AF. A more recent investigation found in the U.S. Geological Survey's Scientific Investigations Report *Hydrologic Requirements of and Consumptive Ground-Water Use by Riparian Vegetation along the San Pedro River, Arizona* (321 Report) (Leenhouts *et al.* 2006) has determined that riparian ET consumes approximately 10,825 AF. The 3,125 AF of additional discharge to riparian vegetation (10,825 AF minus 7,700 AF) increased the magnitude of the negative aquifer storage change from 3,500 AF to 6,625 AF.

Actions taken by non-Federal entities and in particular, the USPP (see description of Regional Efforts through the USPP in the Description of the Proposed Conservation Measures section, above), to minimize ground water use and increase recharge are also cumulative effects. These mitigative efforts are described in Tables 2 and 3 in succeeding versions of the 321 Report [USDI 2004, 2005, and 2006 (*in prep.*)]. We have elected, however, to employ the improved water accounting methodology developed by Fort Huachuca and employed in the Revised PBA because it relies upon up-to-date hydrological and ecological analyses (specifically, Thomas and Pool 2006, Leenhouts *et al.* 2006; Baille 2005) combined with the results of prior, rigorous studies (Goode and Maddock 2000; Corell *et al.* 1996; Freethey 1982; Vionnet, 1992). This revised methodology supersedes the methodology analyzed in our 2002 biological opinion.

Moreover, as stated previously, the revised methodology seeks to empirically determine on- and off-Post human population and associated net water use rather than relying on assumptions that Fort Huachuca is responsible for a fixed percentage of the Sierra Vista Subwatershed population and therefore, a fixed percentage of a regional water deficit. Fort Huachuca's on-Post population is relatively static compared to the regional population, which is subject to a sustained growth rate larger than that of the installation (see Appendix I of the Revised PBA). Under the superseded 2002 methodology, increases in regional population would create increases in total water use, a fixed portion of which would be the responsibility of Fort Huachuca, regardless of whether that population growth was the result of Fort activities.

To reiterate, Table 12, above, and 12.5 in the Revised PBA state that Fort Huachuca's change in aquifer storage was 1,942 AF in 2005; it is projected to decrease to 1,418 AF by 2016. Any remaining aquifer storage change is attributable to other Federal agencies and, in a greater proportion, to non-Federal entities, specifically, water companies and private water users within the City of Sierra Vista, Huachuca City, and unincorporated areas of Cochise County.

A cursory analysis of this cumulative pumping conducted by Runyon (pers. comm. 2007) and FWS indicates that the non-Fort Huachuca aquifer storage change is 3,157 AFA in 2005 and will be 3,779 AFA in 2016. Regardless of the actual volume of the storage deficit, total water use by non-Federal entities is likely to continue to increase, thus capturing increasing volumes of water otherwise destined for discharge, as base flow, at the Babocomari and/or San Pedro rivers. Table 13, below, is a further adaptation of Table 12.5 from the Revised PBA, and includes estimates of cumulative impacts to the regional aquifer and the resulting decreases in baseflow. Table 13 is also accompanied by a narrative estimate of Federal, non-Fort Huachuca water use in the Sierra Vista Subwatershed.

Table 13 - Further Adaptation of Table 12.5 from the Revised PBA: Estimated range of impacts on natural discharge from sources other than Fort Huachuca. Note that the original Table 12.5 in the Revised PBA considers a range of water yield and discharge values based on differing population estimates. FWS has only considered the greater values, as they were based on more accurate population estimates.

A	B	C	D	E	F	G	H
Year	Gross ground water demand (AFA)	Net (with recharge, without easements) ground water demand (AFA)	Change in storage (AFA) (55% storage-derived fraction of Column C)	Change in natural discharge without easements (AFA) (45% capture-derived fraction of Column C)	Change in natural discharge with easements (AFA)	Change in ET (AFA) (64% ET-derived fraction of Column F)	Change in baseflow (36% stream discharge fraction of Column F, converted to CFS)
2005	5,616	3,157	1,736	1,421	N/A	909	0.71
2016	6,739	3,779	2,078	1,701	N/A	1,088	0.85

Cumulative effects are anticipated to cause a maximum potential 0.71 cfs reduction in baseflow as determined using 2005 net ground water demand increasing to 0.85 cfs using the estimated net ground water demand in 2016. While these values appear modest, they are appreciably larger than the corresponding values for Fort Huachuca. Whereas Fort Huachuca's estimated maximum potential impact to baseflow was 0.3cfs resulting from its 2005 net ground water demand, the cumulative effect is 0.71 cfs, 234 percent greater. At 2016, the gap between Fort

Huachuca's potential baseflow impact of 0.04 cfs resulting from its predicted net ground water and the cumulative effect of 0.85 cfs from the remaining net ground water demand in the Sierra Vista subwatershed widens to 2,125 percent. The net ground water demand column in Table 13, above, considers the mitigative effects of recharge from treated effluent, septic systems, and enhanced urban-area runoff but, absent additional mitigation efforts, the increase in total water use may be substantially unmitigated.

This increasing cumulative effect is largely the result of the continually increasing (two percent per annum) human population of the subwatershed. Fort Huachuca does not anticipate similar growth. Local population growth is therefore on a distinct trajectory with a decreasing influence from the presence of Fort Huachuca over time.

Decreasing trends in baseflow have already been noted in the upper reaches of the San Pedro River within the United States. Thomas and Pool (2006) found that "...summer flows at Palominas significantly or nearly significantly decreased from 1931 and 1951 to 2002." Thomas and Pool (2006), further stated that the statistically nonsignificant, but still measurable, decreasing trends in summer flows at Palominas from 1961 and 1971 to 2002 "...may be related to the large gap in the flow record from 1982 to 1995." It is hypothesized that these declining trends may be due in part to water-intensive mining operations in Cananea, Sonora, but it is likely that the pumping of ground water in unincorporated areas within Cochise county is contributing to the negative trends that did exhibit statistical significance.

Long-term trends at the Tombstone gage, where the full effect of activities in the Sierra Vista metropolitan area would be manifest, are more difficult to predict owing to an incomplete gaging record and the intermittent nature of the stream below this gaging station. Modeling suggests that base flows have declined, but no significant trends in flow with time were discernable from a statistical analysis of the data. A raster plot of zero flow days (see Figure 26, section 3.6.3.2 of the Revised PBA) suggests an increasing number of no-flow days in the fall and winter after 1996. In these lower reaches of the San Pedro River within the Sierra Vista Subwatershed, where intermittency is potentially already increasing, estimated decreases in baseflow, using predicted 2005 and 2016 net ground water demand, of 0.71 cfs and 0.85 cfs, respectively, would be appreciable and could contribute to further intermittency. It is anticipated that baseflow declines would have the greatest effect on Huachuca water umbel occurring in the river reach between Fairbank and the northern boundary of the San Pedro RNCA (Tombstone gage section), though the three other occupied reaches [from Charleston northward to Fairbank (Brunchow Hill) section, from Highway 90 north to Charleston (Lewis Spring section), and from Hereford north to Highway 90 (near Hereford Bridge section)] could also experience impacts of cumulative pumping in their vicinity.

The analysis in the preceding paragraph also applies to Huachuca water umbel critical habitat within the San Pedro RNCA. The primary constituent element most likely to be effected by cumulative population growth and ground water depletion within the action area is the presence of sufficient perennial base flows to provide a permanently wetted substrate for growth and reproduction of the species.

The cumulative effects analysis contained in the preceding paragraphs is the result of a relatively simple series of calculations of pumping and recharge not attributable to Fort Huachuca. It must be noted, however, that a certain proportion of this non-Fort Huachuca pumping can be attributed

to other Federal agencies operating and administering programs in the Sierra Vista Subwatershed. The effects of actions taken by these other Federal agencies are not cumulative to the proposed action and are, instead, considered part of the environmental baseline for the action area.

The number of non-Fort Huachuca Federal employees and associated personnel such as contractors, and permittees residing and using ground water within the Sierra Vista Subwatershed is very likely to be a small percentage of the total local population. Next to Fort Huachuca, the second-largest Federal employer in the Sierra Vista Subwatershed is the Department of Homeland Security (DHS) - Bureau of Customs and Border Protection (CBP). In Table 4.1 of that agency's January 2004 *Final Biological Assessment, Office of Border Patrol, Tucson Sector, Arizona* (CBP 2004), it is stated that 203 agents are assigned to the Naco Station. Even allowing for expanded numbers of agents since 2004, support staff, contractors, families and an induced population, we feel it is unlikely that there are more 1,000 individuals living in the Sierra Vista Subwatershed because of the presence of DHS-CBP. Other Federal agencies with which FWS is familiar include the BLM and Forest Service. The BLM maintains both district and project-level staff in Sierra Vista. The Forest Service maintains a district ranger station in Hereford. These relatively minimally-staffed offices are unlikely to account for more than 100 individuals (each) in direct and induced population, and we anticipate even smaller numbers for other Federal agencies that may maintain staff and offices within the Sierra Vista Subwatershed.

We have no definitive methodology for calculating the water use attributable to these other Federal agencies but feel that it likely represents a small fraction of the approximately 32,000 people present in the Sierra Vista Subwatershed because of Fort Huachuca and therefore, a yet-smaller fraction of the cumulative water uses shown in Table 13, above. The increased removal of ground water from storage, increased proportion of capture from discharge, and decreased baseflows appearing in Table 13, and the worsening adverse effects associated with them, are thus largely the result of non-Federal, and thus cumulative actions.

It must be noted that these cumulative, residual ground water storage deficits, and eventual reduction in base flow predicted from ground water demand in the target year 2016 can be expected to affect the base flow hydrology of the San Pedro River at some point in the future beyond 2016. The estimated magnitude of the impacts represents a worst-case scenario since it assumes that all baseflow is derived from the discharge of ground water from the regional aquifer, a situation that is known to be incorrect based on radioisotope studies cited in the PBA (Pool and Coes 1999, Baillie 2005). These studies suggest appreciable baseflow contributions from rainfall and overbank flood events; sources of water not considered in the calculations appearing in Table 13.

Many other activities that may impact the Huachuca water umbel in the area would also be considered Federal actions, and thus are not considered cumulative effects. Exceptions may include activities on private lands in Scotia and Bear canyons on the west slope of the Huachuca Mountains, and at other sites in the San Rafael Valley. The most likely impacts in these areas would be livestock grazing. The water umbel is apparently able to coexist with well-managed livestock grazing; however, historic and long-term effects of grazing on riparian systems supporting the water umbel have been detrimental. Effects of livestock grazing on the water

umbel on lands managed by the Coronado National Forest were recently addressed in a formal section 7 consultation.

The effects of undocumented aliens (UDA) have not been analyzed in depth but there is the potential that foot traffic within the San Pedro RNCA and through Garden and McClure canyons could result in trampling of Huachuca water umbel and increased exposure to wildfire risk.

Conclusion

We reviewed the current status of the Huachuca water umbel, the environmental baseline for the action area, and the effects of the proposed action. We could not consider cumulative effects in our conclusion pursuant to Section 321 of the Defense Authorization Act of 2004. It is our biological opinion that the proposed action is not likely to jeopardize the species or adversely modify or destroy critical habitat. In making our determination we considered the following:

- The status of Huachuca water umbel appears to be stable within its known range in the U.S. and Mexico. The species' status appears to be similarly stable on Fort Huachuca and on the San Pedro River within the San Pedro RNCA.

- The proposed action may affect Huachuca water umbel population sites in Garden, Sawmill, and McClure canyons on Fort Huachuca, but these effects will be minimized through the proposed conservation measures and the species' resilience and adaptation to occurrence in disturbance-prone ecosystems.

- The proposed action will affect Huachuca water umbel within the San Pedro RNCA through small reductions in base flow during those times when flows are at near-zero levels (and when monsoon runoff and/or natural variability is not a factor). It is not known when such events would occur. While these reductions may reduce the vigor and/or linear distribution of population sites in drought years, the species is anticipated to remain able to recolonize such sites in years of normal or above-normal precipitation.

- Effects to critical habitat in Garden Canyon result primarily from ground disturbance and are minimized by Fort Huachuca's ongoing efforts to limit access to wetland sites. Effects to critical habitat on the San Pedro River within the RNCA will be minimized by Fort Huachuca's proposed reductions in removal of ground water from storage and capture of natural discharge.

- The aforementioned effects are small in magnitude, largely minimized, and will not affect Huachuca water umbel recovery.

- Monitoring will be performed to verify the status of the species within the action area and to evaluate the effectiveness of the conservation measures.

INCIDENTAL TAKE STATEMENT

Sections 7(b)(4) and 7(o)(2) of the Act do not apply to listed plant species. However, protection of listed plants is provided to the extent that the Act requires a Federal permit for removal or reduction to possession of endangered plants from areas under Federal jurisdiction, or for any act that would remove, cut, dig up, or damage or destroy any such species on any other area in knowing violation of any regulation of any State or in the course of any violation of a State criminal trespass law. Neither incidental take nor recovery permits are needed from us for implementation of the proposed action.

Huachuca water umbel is protected as a highly safeguarded, protected native plant under Arizona State Law (Arizona Revised Statutes §§3-900-916 and Arizona Administrative Code Article 11, §§ R3-3-1101-1111). State permits may be required in order to translocate this species.

Conservation Recommendations

Sections 2(c) and 7(a)(1) of the Act direct Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of listed species. Conservation recommendations are discretionary agency activities to minimize or avoid effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information on listed species.

The recommendations provided here do not necessarily represent complete fulfillment of the agency's section 2(c) or 7(a)(1) responsibilities for the Huachuca water umbel. In furtherance of the purposes of the Act, we recommend consideration of the following actions:

- We recommend that Fort Huachuca continue to monitor the status of Huachuca water umbel on the installation as well as continue to work with the BLM to monitor the status of umbel and its critical habitat in the San Pedro NCA.

- The Fort should continue to refine the methodology by which impacts to the regional aquifer and baseflows in the Babocomari and San Pedro rivers are measured and minimized. In particular, Fort Huachuca should help develop realistic model scenarios to be applied to the USGS ground water model, currently in preparation.

- We recommend that Fort Huachuca staff participate in the Huachuca water umbel Recovery Team, which is anticipated to be convened in 2007.

- Fort Huachuca should continue to work with the USPP to develop and implement additional measures to reduce potential adverse effects to the Huachuca water umbel.

In order that we are kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, we request notification of the implementation of any conservation recommendations.

Effects of the Proposed Action - Southwestern Willow Flycatcher

Southwestern willow flycatchers are not presently known to occur within the boundaries of Fort Huachuca, but the San Pedro River within the San Pedro RNCA is considered occupied based on a recent history of detections of breeding pairs (see Environmental Baseline, above). The proposed action's effects to southwestern willow flycatchers are therefore primarily indirect, resulting from Fort Huachuca's withdrawal of ground water from aquifer storage and the capture of San Pedro River discharge (see the Off-Post/San Pedro RNCA subsection of the Effects of the Proposed Action section pertaining to Huachuca water umbel, above, for discussion on the concepts of ground water storage and capture).

The proposed action is anticipated to have resulted in a loss of 0.3 cfs of baseflow as of 2005, with that diminishment anticipated to decrease to 0.04 cfs by 2016, the planning horizon for this consultation.

Southwestern willow flycatchers occupy habitat ranging from tamarisk-dominated ecosystems to cottonwood-willow galleries to high alpine willow ecosystems. While the cottonwood-willow gallery forest is extensive on the upper San Pedro River, it is limited in lateral extent by an entrenched stream channel. Regardless, most documented southwestern willow flycatcher nesting attempts within the San Pedro RNCA, the most recent of which was in 2005, have been in this habitat type. The cottonwood-willow forest will thus serve as a proxy for all flycatcher habitat types potentially affected by the proposed action.

Leenhouts *et al.* (2006) found that variation in streamflow permanence explained most variation in abundance of cottonwood and willow. The authors postulated, however, that streamflow permanence was likely a surrogate for the long-term ground water fluctuation under the flood plain. Dense, age-diverse cottonwood –willow stands tend to occur along perennial or intermittent rivers where depth to ground water remains less than approximately 3 meters (m) (Stromberg *et al.* 1991, Anderson 1995, Shafroth *et al.* 1998, Horton *et al.* 2001, as cited in Leenhouts *et al.* 2006). The small alteration to base flow (0.3 cfs from 2005 net ground water demand, 0.04 cfs from 2016 net ground water demand) attributable to Fort Huachuca's capture of ground water is unlikely to appreciably increase depth to ground water or to appreciably increase intermittency or decrease streamflow permanence. The proposed action is also anticipated to have no impact on flood hydrology or alluvial ground water level fluctuations.

The Babocomari Cienega appears to be capable of supporting southwestern willow flycatchers, but surveys conducted under contract to Fort Huachuca from 2003 – 2006 failed to detect the species. Given the 10-year duration of the proposed action, it is possible that southwestern willow flycatchers could begin to breed at Babocomari Cienega. The revised PBA also includes a summary of Houser (1998) and ADWR (1991) that indicate the cienega is up-gradient from Fort Huachuca's ground water pumping centers and is more likely maintained by ground water movement from the south (Mustang Mountains).

The Babocomari River presently exists in a baseline state characterized by varying degrees of degradation. Ground water pumping at Fort Huachuca and by Sierra Vista may have contributed to the degradation of riparian woodlands on the Babocomari River downstream of Huachuca City (Schwartzman 1990). Continued ground water pumping at 1990 rates was predicted to result in ground water declines of 5.8 to 11.5 feet in 50 years, and 8.6 to 20.5 feet in 100 years in an

area of considerable riparian vegetation downstream of Huachuca City (Schwartzman 1990). These declines are large enough to prevent recruitment of cottonwoods and willows, and will likely result in death of mature riparian trees (ADWR 1994, Stromberg *et al.* 1996, Anderson 1995). It is also unknown whether this area would have potential to support flycatchers absent ground water pumping. It must be noted that these predictions were made absent consideration of Fort Huachuca's currently-proposed conservation measures, which will reduce ground water storage deficits attributable to the installation

Southwestern willow flycatcher critical habitat on the San Pedro River is limited to the lower reaches of the stream, below the narrows. The upper and lower reaches of the San Pedro River are, however, hydrologically connected (Haney and Lombard 2005). Diminishment of discharges in the upper San Pedro River could affect discharge in the lower reaches. Most of the San Pedro River from Benson northward is intermittent (ADWR 1991), thus flow between the basins occurs primarily as subsurface flow and flood flow. The reach from near the Aravaipa confluence downstream to the Gila River is described as intermittent by ADWR (1991), but perennial pools and river segments occur in adequate numbers to support fish populations. A perennial reach of about four miles in length occurs south of Redington where ground water is forced to the surface by shallow bedrock. A perennial cienega occurs at Cook's Lake approximately 1.5 miles downstream of the Aravaipa confluence (ADWR 1991). Reaches adjacent to lands recently placed into conservation ownership/management may exhibit greater degrees of flow permanence than described by ADWR (1991). These reaches, with adjacent lands owned variously by the Bureau of Reclamation, Salt River Project, The Nature Conservancy, and Resolution Copper, have tended to return to increasing durations of surface flow, if not perennial flow, upon cessation of alluvial ground water pumping.

Eighteen percent (7,054 af) of the annual water volume that leaves the Sierra Vista Subwatershed flows all the way to the Winkelman subwatershed (ADWR 1991). This amount includes flood flows; the volume of base flows would be much less due to the intermittency of such surface water. Ground water inflow across subwatershed boundaries in the lower San Pedro River is said to be insignificant (ADWR 1991), though recent work by Haney and Lombard (2005) suggests such a determination may require reconsideration. Given present assumptions, however, it can be expected that only an immeasurably small fraction of the minor baseflow depletions resulting from the proposed action would reach the Sierra Vista Subwatershed boundary, much less the Winkelman Subwatershed and Gila River confluence.

Flow between subwatersheds might be greater if water use did not exceed water supply in the Sierra Vista Subwatershed, but because of the presence of a cone(s) of depression, it is unlikely that any increased water supply would result in significant increases in subwatershed outflow. Even if the entire deficit was discharged as outflow from the Sierra Vista Subwatershed, only 18 percent of that figure would be expected to reach the Winkelman subwatershed. Annual water supply to the Winkelman subwatershed is 73,760 ac-ft, thus under this scenario, eliminating the deficit in the Sierra Vista Subwatershed and diverting all of the gain to subwatershed outflow would cause no more than approximately 2 percent increase in annual inflow into the Winkelman subwatershed, under the most optimistic conditions. The proposed action will thus have minimal to no effect on southwestern willow flycatcher critical habitat on the lower San Pedro River.

Table 17 in the Revised PBA describes funding for monitoring of threatened and endangered species. It is our assumption that such monitoring will continue under extant methodologies, with

opportunity for revision during annual coordination meetings. It shall be noted that surveys for southwestern willow flycatcher require permits form both the FWS and AGFD.

Cumulative Effects

See the Cumulative Effects section for the Huachuca water umbel, above, for a general description of cumulative effects and a discussion of analysis of those effects per Section 321 of the Defense Authorization Act of 2004.

Cumulative effects to the southwestern willow flycatcher are associated primarily with the effects of non-Federal water use within the Sierra Vista Subwatershed to birds that occur on the San Pedro River. The cumulative effects analysis for the Huachuca water umbel, above, contains an analysis of the magnitude of baseflow impacts to the San Pedro River. To reiterate, the cumulative effect of population growth in the Sierra Vista Subwatershed is anticipated to eventually result in a decrease in baseflow discharges of up to 0.71 cfs as determined from the 2005 net ground water demand, increasing up to 0.85 as determined from 2016 net ground water demand.

These effects appear to be of a low magnitude, but they are appreciably greater than the baseflow impacts associated with Fort Huachuca's proposed action. Moreover, whereas Fort Huachuca's effects to baseflow are anticipated to decrease between 2005 and 2016, the cumulative effects to baseflow are anticipated to increase. We are concerned that increasing intermittency in any reach of the San Pedro River will result in changes in riparian condition class as described in Leenhouts (*et al.* 2006). These authors found that variation in streamflow permanence, likely as a surrogate for long-term ground water fluctuation, explained most variation in abundance of cottonwood and willow and, to an extent, the greater proportion of mesic pioneer trees – tamarisk in particular – that are more prevalent in downstream reaches of the action area. The increasing cumulative alteration in base flow attributable to cumulative sources of ground water capture may appreciably increase depth to ground water or appreciably increase intermittency or decrease streamflow permanence. In this event, we can expect a transition to more-xeric riparian condition classes and/or a southern expansion of the mesic pioneer species already present in downstream reaches. These vegetative communities, and the decreased surface flows that accompany them, are less likely to support southwestern willow flycatcher breeding, thus reversing a trend of riparian community succession that may lead to increased instances of breeding.

Of great concern, and also related to ground water elevation and baseflow, is the potential for additional mineral or agricultural development and associated pumping of ground water in the floodplain of the San Pedro River in either the U.S. or Mexico portions of the river. Extensive acreage exists in Mexico and on private and state lands within the U.S. portion of the watershed that could potentially be developed for agriculture. This may become less of a threat if initiatives to designate irrigable lands as irrigation non-expansion areas or if purchase of lands or easements from willing sellers are implemented.

The cumulative effect of increases in total ground water pumping and decreasing base flow are not anticipated to be of sufficient magnitude to reach southwestern willow flycatcher critical habitat downstream. As stated previously, 18 percent of the annual water volume that leaves the Sierra Vista Subwatershed flows all the way to the Winkelman subwatershed (ADWR 1991),

where most San Pedro River critical habitat exists. The 18 percent of annual volume includes flood flows; the volume of base flows would be much less affected due to the intermittency of such surface water. It is expected that only an immeasurably small fraction of the minor baseflow depletions resulting from the proposed action would reach the Sierra Vista Subwatershed boundary, much less the Winkelman Subwatershed and Gila River confluence.

Conclusion

We reviewed the current status of the southwestern willow flycatcher, the environmental baseline for the action area, and the effects of the proposed action. We could not consider cumulative effects in our conclusion pursuant to Section 321 of the Defense Authorization Act of 2004. It is our biological opinion that the proposed action is not likely to jeopardize the species or adversely modify or destroy critical habitat. In making our determination we considered the following:

- Southwestern willow flycatchers are not presently known nor are they anticipated within the next 10 years to occur within the boundaries of Fort Huachuca. The species is thus unlikely to be subject to the direct, land-disturbing effects of the proposed action;

- The indirect effect of ground water pumping by Fort Huachuca and the installation's induced population within the Sierra Vista Subwatershed may have affected base flows in the San Pedro. The magnitude of this impact based on the estimated 2005 net ground water demand would be a maximum of 0.3 cfs and is anticipated to be reduced to 0.04 cfs through conservation measures planned through 2016. Given baseline levels of intra- and interannual hydrologic variation, this minimal impact is not anticipated to change the extent or recruitment of riparian vegetation (migration and breeding habitat) on the San Pedro and Babocomari rivers;

- The area affected by the proposed action is small relative to the area occupied by the species.

- The 0.3 to 0.04 cfs impact to baseflow is small and unlikely to affect southwestern willow flycatcher critical habitat in the lower reaches of the San Pedro River.

- The aforementioned effects will not affect the ability to recover the southwestern willow flycatcher.

- Monitoring will be performed to verify the status of the species within the action area and to evaluate the effectiveness of the conservation measures.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is defined (50 CFR §17.3) to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. "Harass" is

defined (50 CFR §17.3) as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding or sheltering. "Incidental take" is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity.

Under the terms of sections 7(b)(4) and 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are non-discretionary, and must be undertaken by Fort Huachuca so that they become binding conditions of any grant or permit issued to the applicant, as appropriate, for the exemption in section 7(o)(2) to apply. Fort Huachuca has a continuing duty to regulate the activity covered by this incidental take statement. If Fort Huachuca: (1) fails to assume and implement the terms and conditions; or (2) fails to require the applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, Fort Huachuca must report the progress of the action and its impact on the species to the FWS as specified in the incidental take statement (50 CFR §402.14(i)(3)).

Amount or Extent of Take Anticipated

We do not anticipate the proposed action will incidentally take any southwestern willow flycatchers because: (1) no birds are known to occur on Fort Huachuca; (2) the magnitude of hydrologic impacts to the occupied portion of the San Pedro River is small, thus having no measurable effect to feeding, breeding, or sheltering; and (3) the flood flow hydrology of the San Pedro River will not be altered.

Conservation Recommendations

See the Conservation Recommendations section for the Huachuca water umbel, above, for information regarding the statute and policy governing Fort Huachuca's implementation of the following recommendations:

1. The Fort should assist with implementation of recovery actions found in the Southwestern Willow Flycatcher Recovery Plan (FWS 2002a);

2. The Fort should continue to help refine the methodology by which impacts to the regional aquifer and baseflows in the Babocomari and San Pedro rivers are measured and minimized. In particular, Fort Huachuca should help develop realistic model scenarios to be applied to the USGS ground water model, currently in preparation.

3. The Fort should continue to conduct FWS protocol-level surveys for the species as stated in the Description of the proposed Conservation Measures section, above.

Effects of the Proposed Action - Mexican Spotted Owl

Twenty-six Mexican spotted owl management territories, also called Protected Activity Centers (PACs) are known from the Huachuca Mountains, including ten within Fort Huachuca boundaries (two which were designated in 2006), fifteen on Coronado National Forest (Sierra Vista Ranger District) lands and one on National Park Service lands within Coronado National Memorial to the south of Fort Huachuca (Glenn Frederick, pers. comm. 2006 as cited in the Revised PBA). Mexican spotted owls occurring on Fort Huachuca are directly and indirectly affected by human disturbance, potential direct mortality, noise, and fire.

Effect of Human Disturbance

Mexican spotted owl territories and PACs are situated in the canyons of the Huachuca Mountains where ground-based military training is limited primarily to existing routes of travel. Most human use of these areas is non-military in nature, and occurs primarily as recreational pursuits such as birding, butterfly observation, hunting, and hiking.

Recreational use in most canyons where territorial Mexican spotted owls have been recorded, or that contain PACs, is light because to reach these areas often requires considerable hiking over steep terrain. An exception is the PAC in Scheelite Canyon, which is well-known by birders as an easily accessible site to view Mexican spotted owls. Davis and Russell (1995) and Taylor (1995), popular birding guides for southeastern Arizona, provide directions to the site, and in the case of Taylor (1995), specific information on where the birds can be found. Most birders visiting Scheelite Canyon stay on the trail, and are conscientious and unobtrusive.

The response of wildlife to recreational disturbance is complex, and the effects are not immediately obvious or easily determined (Hammitt and Cole 1987; Flather and Cordell 1995). Evidence suggests that recreational activity can harm wildlife (Knight and Cole 1995). Tolerance levels for wildlife interactions with humans will vary by time of year, breeding season, age, habitat type, and individual experience with recreationists (Hammitt and Cole 1987). Human activities can impact wildlife directly through exploitation and disturbance, or indirectly through habitat modification and pollution. Concerns with regards to the canyons in which owls are present include current and future recreation use and the potential direct effects to the Mexican spotted owl of disturbance and harassment, and to a lesser extent, the indirect effects of prey habitat modification. The Mexican Spotted Owl Recovery Plan indicates that the determining factor of a recreational activity's impact on spotted owls is a combination of its location, intensity, frequency, and duration.

The physical characteristics of a canyon may provide topographic screening. Topographic screening between the area of disturbance and a bird's location creates a noise buffer, and may assist in the reduction of noise disturbance (Knight and Cole 1995). The physical structure of canyons can also tend to magnify disturbances and limit escape/avoidance routes for owls (FWS 1995b). Scheelite Canyon is a narrow, deep canyon with limited perching and roosting sites, and the owls are typically perched close to the trail.

The Mexican spotted owl Recovery Plan states that groups of 12 or more hikers or a steady stream of hikers occurring in narrow canyon bottoms may be especially disturbing to owls. The spotted owl breeding season, which extends from March 1 through August 31, is an especially

popular time for birders and other recreationists to visit Fort Huachuca. In addition, during high use periods, large groups of hikers may use the trail, whether intentionally hiking in groups, or because groups are formed unintentionally due to hikers backed up behind each other. The potential for disturbance to Mexican spotted owls in the PAC exists given the trail location relative to past owl locations, as well as the high recreational use level on the trail during the breeding season.

There are three learned responses wildlife may show to recreationists: habituation, attraction, and avoidance (Knight and Temple 1995). Recreational disturbance during the breeding season may affect an individual's productivity; disturbance outside the breeding season may affect the individual's energy balance and, therefore, its survival. Birds may respond to disturbance during the breeding season by abandoning their nests or young, by altering their behavior such that they are less attentive to the young, which increases the risk of the young being preyed upon, or by disrupting feeding patterns, or by exposing young to adverse environmental stress (Knight and Cole 1995).

Owls have more sensitive hearing than other birds (Bowles 1995). If a noisy sound source arouses an animal, it has the potential to affect its metabolic rate by making it more active. Increased activity can, in turn, deplete energy reserves (Bowles 1995). Noisy human activity can cause raptors to expand their home ranges, but often the birds return to normal use patterns when the humans are not present (Bowles 1995). Such expansions in home ranges could affect the fitness of the birds, and thus their ability to successfully reproduce and raise young. Species that are sensitive to the presence of people may be displaced permanently, which may be more detrimental to wildlife than recreation-induced habitat changes (Hammitt and Cole 1987; Gutzwiller 1995; Knight and Cole 1995). If animals are denied access to areas that are essential for reproduction and survival, then that population will decline. Likewise, if animals are disturbed while performing essential behaviors such as foraging or breeding, that population will also likely decline (Knight and Cole 1995). There is also evidence that disturbance during years of a diminished prey base can result in lost foraging time which, in turn, may cause some raptors to leave an area or not to breed at all (Knight and Cole 1995).

There are no completed studies to date on the effects of recreational activities specific to the Mexican spotted owl. Research on all subspecies of the spotted owl indicate that it exhibits docile behavior when approached by researchers, and there is no clear evidence of significant impact by research activity except for a negative effect on reproduction from back-pack radio transmitters (Gutierrez *et al.* 1995). However, researchers purposefully make as little noise as possible, and disturbance is very limited in duration. In the long term, some species may become less responsive to human disturbance if they are not deliberately harassed; others may become very stress-prone towards humans (Bowles 1995; Hammitt and Cole 1987). Excessive interaction with humans may cause a lowering of call response rates or habituation; the effects of habituation on spotted owls are unknown (Gutierrez *et al.* 1995). Owls have been known to begin calling during the breeding season in response to the sound of human voices (M. James, FWS, Flagstaff, pers. com. 1998 as cited in the Revised PBA). Such behavior is likely characteristic of a certain percentage of individuals, and this response to humans may create a situation where these owls are discovered by hikers, thereby exposing themselves to potential direct impacts.

Ecologists suspect that spotted owls select habitats partially because of the availability of prey (FWS 1995b). Ward and Block (1995) found that the reproductive success of the Mexican spotted owl was not influenced by a single prey species, but rather by many species in combination. Trails in riparian areas affect the soil and riparian vegetation adjacent to the trail, as well as the aquatic system itself. By directly impacting these components, recreationists affect an animal's food supply and availability as well as its habitat; in turn, impacts on food and habitat influence behavior, survival, reproduction, and/or distribution (Cole and Landres 1995). Impacts on soil include compaction of mineral soil, reductions in total porosity, reductions in infiltration rates, and increased soil erosion (Cole and Landres 1995). These changes in soil characteristics can adversely affect the germination, establishment, growth and reproduction of plants. Direct impacts to vegetation also come from crushing and uprooting of vegetation. Consequently, recreation areas characteristically have vegetation that is less abundant (reduced density and cover), of a reduced stature, and with different species composition from undisturbed areas (Cole and Landres 1995). Removal of living vegetation affects the habitat and food sources of small mammals (Hammitt and Cole 1987) that comprise owl prey items.

The owls in Scheelite Canyon appear to be mostly oblivious to human presence. However, there is some evidence of trampling and soil compaction off the established trail, and in recent years large groups of birders, apparently birding tour groups, have visited the canyon. Russell Duncan (pers. comm. 1998 as cited in the Revised PBA) reported a group of approximately 50 birders led by a trip leader that was calling or hooting for owls in Scheelite Canyon. The FWS requires a Section 10(a)(1)(A) permit for use of tape recorded calls or hooting to locate Mexican spotted owls. The FWS does not issue such permits for commercial or recreational viewing of listed species. Also, as discussed, a group of 50 individuals may be a large enough presence to elicit an alarm response or to otherwise harm or harass the spotted owls in Scheelite Canyon, or disturb habitat (FWS 1995b). In December 1992, Duncan *et al.* (1993) found an adult female spotted owl in Scheelite Canyon on the ground in a lethargic state. The bird was taken to a veterinarian in Tucson where it died after seven days. The cause of death was a pneumonia-like lung infection complicated by a subdermal hematoma probably caused by a blow to the back of the head. Duncan (1993) stated that a human-related cause of the hematoma can not be ruled out.

The Mexican spotted owl Recovery Plan notes that birders and wildlife photographers actively seek spotted owls and are therefore more disruptive than the accidental encounters associated with other recreational activities. The Mexican spotted owl Recovery Plan goes on to say that hooting for spotted owls or using mousing techniques to attract owls, if practiced to excess, may disrupt an owl's territorial, mating, and nesting activities (FWS 1995b). The Mexican spotted owl Recovery Plan finds that most owls appear to be relatively undisturbed by groups of people of 12 or less. In response to the recommendations of the Mexican spotted owl Recovery Plan, Fort Huachuca has posted and maintained a sign at the mouth of Scheelite Canyon that informs visitors that groups are limited to 12 or less; calling, hooting, or playing taped recordings to elicit responses from owls is prohibited; and that visitors should stay on the trail and be as quiet and unobtrusive as possible. This is intended to reduce possible harassment or disruption of Mexican spotted owls in the canyon.

Hunting for big and small game is allowed within spotted owl habitat at Fort Huachuca. Potentially, a hunter could discharge a firearm near a roosting or nesting spotted owl and cause an owl to flush or elicit a startle response. However, this type of disturbance is likely to be

infrequent. Most hunting occurs during the fall and winter months, outside of the spotted owl breeding season, and at lower elevations.

Rappelling or rock climbing on cliffs supporting active Mexican spotted owl nests could result in disturbance of nesting owls. Recreational rappelling and rock climbing are prohibited on Fort Huachuca; however, rappelling as part of military training occurs on cliffs in Garden Canyon. The rappelling cliff is located outside of current spotted owl PACs, and if owls are found nesting within 0.25 mile of the rappelling cliff, rappelling shall be moved at least 0.25 mile away during March 1 through August 31, or until nestlings fledge. These measures are intended to reduce the potential for adverse effects to the Mexican spotted owl.

Effects of Direct Mortality

PACs in Training Area Papa are within portions of the firing fan of tank gunnery range 12C. However, this firing range is inactive and, if proposed for use in the future, would be the subject of separate consultation with FWS. PACs in Training Areas Oscar and Sierra fall within portions of firing ranges 12A&B and 9. Range 12B is a tank gunnery range that is currently not in use. As with 12C, if 12B is proposed for future use, it would be the subject of separate consultation. Machine guns (.50 and 90mm caliber) and recoilless rifles are discharged at Range 9. At Range 12A, .50 caliber, 7.62mm, and 40mm weapons are discharged. The PACs are in the upper reaches of the firing ranges, at least 2.4 miles from where weapons would be fired. Ordnance and shells would reach PACs only if the targets were overshot. The likelihood that ordnance or shells would strike a spotted owl or nest is highly unlikely, particularly because owls are typically in wooded canyons that would be sheltered from stray weapons fire. Occasional stray bullets have much greater implications for igniting fire with its associated impacts, as discussed below.

Mortality or injury of Mexican spotted owls could also occur due to collisions with vehicles, aircraft, power/communications lines, or as a result of electrocution on power lines. However, reports of such mortality are rare in Arizona. Mortality or injury from collisions or electrocution could possibly occur during the life of the project, but are unlikely. Moreover, the recently-privatized electrical distribution system on Fort Huachuca will result in the installation of safety devices to reduce the risk of electrocution of raptors.

Effects of Noise

Sources of noise other than those made by hikers or birders may also disturb spotted owls and include explosive ordnance discharge and delivery, discharge of firearms by hunters, small arms ammunition firing on the South Range, and aircraft overflights. Delaney *et al.* (1997) reviewed literature on the response of owls and other birds to noise and drew the following conclusions: (1) raptors are more susceptible to disturbance-caused nest abandonment early in the nesting season; (2) birds generally flush in response to disturbance when distances to the source are less than approximately 200 feet and when sound levels are in excess of 95 dBA; and (3) the tendency to flush from a nest declines with experience or habituation to the noise, although the startle response cannot be completely eliminated by habituation.

Small arms firing on the South Range could potentially disturb Mexican spotted owls. However, the firing ranges are all at least 2.4 miles from spotted owl PACs, and any noise from such firing that reaches the PACs is likely to attenuate well below 95 dBA. Artillery and mortar firing

occurs at several areas on the East Range. Ordnance is directed eastward from these sites and is delivered into Impact Area Zulu, also on the East Range. Noise from these sources is likely louder than the small arms firing on the South Range. However, mortar and artillery firing on the East Range occur at a much greater distance from owl territories. All mortar and artillery firing sites and the impact zone in Impact Area Zulu are over seven miles from the nearest PAC. No effects to spotted owls are anticipated as a result of mortar and artillery firing on the East Range.

Low-level flights are sometimes authorized over the canyons of the Huachuca Mountains where Mexican spotted owls nest.

Propeller-driven, fixed-wing aircraft are typically operated at low levels, though they are also generally limited to elevations of 500 feet above ground level (agl) or higher on Fort Huachuca. The AGFD is granted authority to fly lower to conduct wildlife surveys on Post. Helicopter flights may occur at elevations below 500 feet agl. Unmanned Aerial Vehicle (UAV) flights may also occur at low levels over the Huachuca Mountains. Low-level flights are infrequent and of short duration. During extensive wildlife and plant field work at Fort Huachuca, Russell Duncan (pers. comm. 1998 as cited in the Revised PBA) has not observed low-level fixed wing or helicopter flights in montane canyons, but has observed occasional UAVs flying at low levels. To reduce the potential for noise effects, the Fort is committed to minimizing low-level helicopter flights within one mile of active nests and has prohibited helicopter flights within 0.25 mile of an active nest from March 1 – August 31.

According to the *Report to Congress on Effects of Aircraft Overflights on the National Park System* (NPS 1994), wildlife respond to low-level aircraft overflights, although the manner in which they do so depends on life-history characteristics of the species, characteristics of the aircraft, flight activities, and a variety of factors such as habitat type and previous exposure to aircraft. The primary concern stemming from these low-level overflights related to wildlife are the physiological and/or behavioral responses caused by the flights. These responses may reduce the wildlife's fitness or ability to survive. Overflights may cause stress, and if chronic, stress can compromise the general health of the animal. Overflights may interfere with raising young, habitat use, and physiological energy budget. Indirect effects, such as accidental injury, energy loss, habitat avoidance and abandonment are very difficult to detect, but some experts suspect they occur (NPS 1994).

Other studies that have investigated the effects of low-level aircraft overflights on birds have determined that such flights disturb raptors (Manci *et al.* 1987). Disturbances include interrupting nesting activities by flushing from nesting and roost, displacing birds returning to nests, flushing or displacing birds from foraging areas, provoking interactions with sympatric raptors, and exposing eggs and nestlings to predators and extreme heat. Studies have also suggested that human activities within breeding and nesting territories may affect raptors by changing home range movements (Anderson *et al.* 1990) and causing nest abandonment (Postovit and Postovit 1987, Porter *et al.* 1973). While these studies have not demonstrated a causal link between low-level overflights and reproductive success, they do document a level of disturbance that clearly is equivalent to harassment. Under Section 9(a)(1)(B) of the Act, harassment is a form of take.

Johnson and Reynolds (2002) observed the responses of Mexican spotted owls in Colorado to low-level flights by Colorado Air National Guard F-16 aircraft. The authors found that owl

responses to low-altitude F-16 overflights did not exceed, and were often less than, responses to naturally occurring events (such as thunderclaps).

Compared to jets and light planes, helicopters tend to elicit a heightened response from nesting raptors (Watson 1993, Grubb and Bowerman 1997). Noise from low-level jets and sonic booms have been found to have little effect on nesting peregrine falcons and other raptor species (Ellis 1981, Ellis *et al.* 1991). UAVs are small and relatively quiet, and are expected to elicit less of a response than either helicopters or fixed-wing aircraft. Studies of the effects of aircraft overflights on nesting raptors often show slight, but non-significant decreases in reproductive success and number of young fledged (Platt 1977, Windsor 1977, Anderson *et al.* 1989, Ellis *et al.* 1991). Nest abandonment due to disturbance is most likely to occur early in the nesting season before birds have invested much energy in the nest and nestlings (Knight and Temple 1986). White and Sherrod (1973) found that nesting raptors flushed from nests when overflown by helicopters that approached unseen, suggesting that raptors may be more likely to flush if the noise or sight of the aircraft is sudden and in close range.

Studies of the effects of aircraft overflights on raptors have generally noted a slight but non-significant decrease in reproductive success and number of young fledged at sites exposed to overflights versus control sites without overflights (Delaney, *et al.* 1997). Of the authorized flights over spotted owl habitat, low-level helicopter flights have the greatest potential to disturb owls (Delaney *et al.* 1997), because they move slowly and are relatively noisy. Delaney *et al.* (1999) evaluated the effects of the Sikorsky, HH-60G, and Pave Hawk helicopter overflights on Mexican spotted owls in the Lincoln National Forest, New Mexico. Owl territories were randomly presented with one of three helicopter flight profiles, including 50 feet vertical, 100 feet vertical/100 feet lateral, and 200 feet vertical. Territories with overflights did not differ in reproductive success from territories without overflights. As the distance to the helicopter decreased, owl flush response increased. Owls did not flush in response to helicopters beyond 345 feet, and no owls flushed during the incubation and nestling phases. Flush responses occurred at a rate of 14 percent within 345 feet, 19 percent within 200 feet, and 50 percent within 100 feet. Flushing responses also did not occur when noise levels were less than 92 dBA; however, distance to the helicopter was a better predictor of spotted owl response than sound level. Net differences in prey deliveries for the 24 hour periods after and before noise manipulations were highly correlated with stimulus distance. Delaney *et al.* (1999) estimated that the threshold for negative effect on prey deliveries was 315 feet. On average, an alert response (i.e., head movements) was elicited when helicopters approached within 1,330 feet, but no response was noted when helicopters were beyond 2,165 feet from an owl. Short duration, single pass aircraft flights appeared to have little effects on spotted owls; diurnal flights affected owls less than nocturnal flights; and although multiple low-level flights were not recommended, the authors believed spotted owls would habituate with repeated exposures and as the nesting season progresses (Delaney *et al.* 1997, 1999). Although the effects of overflights may vary with locations, specific conditions, and aircraft type, the following management implications emerged from the results of Delaney *et al.* (1997, 1999):

1. A 345-foot hemispherical management/protective zone should minimize, and possibly eliminate, spotted owl flush response and negative effects to prey delivery rates associated with helicopter overflights.

2. Flights over owls should be separated by at least seven days.

3. Overflights should be limited to diurnal flights if possible, and nocturnal flights, particularly within three hours of sunrise or sunset, should be minimized.

4. Helicopter flights near roosts or nests that are single pass and of short duration may be less disturbing than other flight maneuvers such as circling, hovering, landing, etc.

The FWS recommends that disturbing activities be limited within 1,320 feet of nest sites during the breeding season (March 1-August 31) (FWS 1995b). This corresponds well with the Delaney *et al.* 1,330-foot threshold for alert responses to helicopter flights. Encounters between low-level flights and spotted owls are expected to be infrequent. Russell Duncan (pers. comm. 1998 as cited in the Revised PBA) during extensive wildlife and plant surveys, has never observed a low-level helicopter or fixed-wing aircraft flight in the Huachuca Mountains. Low-level UAV flights are more common, but UAVs are small and relatively quiet compared to helicopters, and are expected to elicit minimal response from spotted owls. The Fort has committed to minimizing low-level helicopter flights within 1.0 mile of spotted owl nests, or the last previously known nest. Helicopter flights closer than 0.25 mile of active nests will be prohibited from March 1 to August 31. These commitments should minimize adverse effects associated with low-level aircraft flights.

Effects of Fire

Stacey and Hodgson (1995) evaluated the impacts of a 24,000-acre natural fire on Mexican spotted owls in the San Mateo Mountains, New Mexico. Birds present in four territories before the fire remained within their same territories after the fire. However, a small sample size of owls combined with an apparent low-intensity fire (the fire burned patchily, only 600 acres burned hot enough to kill all trees, and much undamaged roosting and foraging habitat remained) makes the applicability of the study results to other owl territories or other fires questionable. Relatively few wildfires have burned in the montane portion of the Fort in recent times (see Figure 32 in the Revised PBA); however, fuel loads are high in some areas (Robinett *et al.* 1997), and several stand-replacing fires have occurred in the Huachuca Mountains to the south of the Fort in recent years. Thus, a very hot, stand-replacing fire could potentially burn in owl territories on Fort Huachuca, perhaps with much more severe impacts than those observed by Stacy and Hodgson (1995) in New Mexico. Prescribed fire, managed natural fire, or wildfire ignited by recreationists or by ordnance strikes in the Huachuca Mountains, could result in adverse effects to owls and their habitat (Danzer 2005). Direct effects to Mexican spotted owls may include death of adults and/or juveniles, flushing of owls off nests/roosts, smoke inhalation, and human disturbance related to fire suppression actions. Indirect effects may include loss or degradation of nesting or foraging habitat, and reduced prey densities and availability.

Patton *et al.* (1991) found lower survival rates among radio-tagged female northern spotted owls following a forest fire. This was attributed to radio tags, but the birds in this study were exposed to dense smoke and high levels of carbon monoxide by an inversion that trapped smoke near the ground for 25 days following a fire which burned for 50 days. Flames and smoke from fire may cause Mexican spotted owls to flush from nests and/or roosts, and may impair hunting opportunities through interfering with audio and visual methods of detecting prey. If fire occurs within PACs, there exists some possibility that nest and/or roosts trees may be killed through

crowning or extreme heat. All of these may result in direct mortality, failed reproductive efforts, and/or starvation of young and adult Mexican spotted owls.

Disturbance to the Mexican spotted owl may also be caused by human activities in, adjacent, and above PACs and potentially occupied habitat during fire suppression or management activities. Disturbance may be caused by fire resource personnel digging fire lines with shovels and other hand tools, walking and igniting with drip torches if "burning out" is needed to control a fire, use of chainsaws and heavy equipment, the dropping of slurry, and monitoring fire conditions from the ground or air. Human disturbance in an occupied PAC during the breeding season may result in failed reproductive efforts, abandonment of the nest, and/or starvation of young.

The indirect effects of fire include both negative and beneficial effects on Mexican spotted owl habitat. Beneficial aspects would include increased response of herbaceous vegetation after a fire and possible reduced future occurrence of stand-replacing fire. Negative effects would include the loss of Mexican spotted owl prey habitat components such as herbaceous cover, down logs and snags. The effects of fire on the prey base of the Mexican spotted owl are complex and are dependent on the variations in fire characteristics and in prey habitat. Fire intensity, size, and behavior are influenced by numerous factors such as vegetation type, moisture, fuel loads, weather, season, and topography. Fire can effectively alter vegetation structure and composition thereby affecting small mammal habitat. The initial effects of fire are likely to be detrimental to rodent populations as cover and plant forage species would be reduced.

Population responses by small mammals to fire-induced changes in their habitat vary. For example, deer mouse populations might increase immediately following fire and then decrease through time (Ward and Block 1995). Campbell *et al.* (1977) noted that populations of peromycid mice decreased immediately following fire in an Arizona ponderosa pine forest that removed one-fourth (moderately burned) to two-thirds (severely burned) of the basal area; populations then returned to pre-fire numbers two years following the burn. Furthermore, no differences were found in rodent populations between moderately and severely burned areas. They concluded that the effects of the fire that they studied were short-term, and the short-term positive numerical responses of mice were attributed to an increase in forage, particularly grasses and forbs after the fire (Ward and Block 1995). Irvine (1991) documented post-fire declines in deer mice populations at study sites on the Coconino National Forest. Irvine attributed these declines to reduced food supplies. Lowe et at. (1978) noted an increase in deer mice populations the first year after a fire in ponderosa pine near Flagstaff, Arizona. Small mammal diversity and densities are typically depressed for one to three years after a fire (Wright and Bailey 1982). Biswell *et al.* (1973) suggested that rodent populations would be less affected during fall fires, because at that time of year rodents have accumulated seed caches that will mitigate loss of food sources. Predation of surviving rodents that are part of the diet of the Mexican spotted owl may increase immediately after the fire. In one study in northern California, radio-collared northern spotted owls spent considerable time in burned-over areas. This activity was assumed to be due to easy capture of prey (Patton and Gordon 1995).

It is suspected that the effects of intense stand-replacing wildfires that dramatically alter forest structure and move the system to earlier successional stages would have longer-term effects on some rodent populations. Likely, early successional species such as deer mice and those that require open habitat with a well-developed herbaceous understory, such as microtine voles and pocket gophers, would benefit. In contrast, species that require a wooded or forested overstory

would exhibit population declines. The net effect of such fires on the Mexican spotted owl is unclear. A fire that removes the tree canopy would likely render a portion of the area unusable for foraging by Mexican spotted owl, but if the spatial extent of crown loss is limited, a mosaic is created that could provide a diversity of prey for the owl and actually be beneficial (Ward and Block 1995). Because owl prey species evolved in ecosystems where fire was a natural process, we assume that historically, these species survived, and some even benefited from the occurrence of fire. Fire has been excluded from most southwestern ecosystems during the 20th century, resulting in systems where fire behavior may deviate substantially from natural conditions. Effects of fire on small mammals under present environmental conditions are unclear (Ward and Block 1995).

Fire is likely to have immediate short-term adverse effects to Mexican spotted owl prey habitat. Although fire may enhance vegetative density and abundance in the long-term, short-term effects of burning, particularly in the spring and early summer when herbaceous vegetation is most critical for reproducing rodents, may limit available forage immediately after the fire event. Wildfire would most likely occur in June before the onset of the summer rains. Nesting Mexican spotted owls would be most affected during this time, as they would be nesting and require a consistent supply of prey to successfully fledge young.

Prescribed and managed natural fires are extremely important management tools needed to enhance, and often to restore many of the ecosystem functions and processes. Reduction in habitat and various habitat-based threats have contributed to the listing of the Mexican spotted owl. The long-term benefits to the Mexican spotted owl of many land management actions may contribute, in the short-term, to certain adverse affects to the owl. Prescribed and natural fire projects often fall into this category. Species such as the owl, whose habitats have been reduced, degraded, or altered, may currently respond to fire differently than they did historically when fire occurred in a more natural setting. Therefore, it is important to address such concerns by minimizing, to the greatest extent practical, those short-term adverse effects, and move forward with proactive land management as fire is applied in efforts to restore ecosystem functions and community dynamics.

Fires have played an important role in the composition and structure of conifer forests. Generally, historic natural fires in ponderosa pine were light, its intensity depending on fuel loadings and weather conditions. This created a situation whereby some areas did not burn, some areas burned intensely with crown fires, and most areas burned lightly leaving large fire resistant trees, killing shrub top growth, and removing dead fuels (Wright and Bailey 1982). In mixed conifer forests, historic fires often were composed of intense, crown-replacement in small patches. Prescribed fire may be expected to alter mixed conifer habitats of the Mexican spotted owl in the short-term to a greater extent now than historically because the fuel accumulations that are characteristic of many Mexican spotted owl nest and roost sites generally place them at higher fire risk.

Prescribed or managed natural fires are likely to create small openings in the canopy caused by single or groups of trees crowning. The risk of trees crowning is more probable in Mexican spotted owl nesting/roosting habitat. The location of quality owl habitat often corresponds to characteristics that put these sites at higher risk of crowning such as dense, multi-layered canopies, and high fuel loadings resulting from high densities of down logs. Where fire does not crown, some loss of the lower canopy is expected. This is likely to be particularly true in mixed

conifer habitats which are usually denser and contain more of the "ladder fuels" created by smaller conifer trees. The loss of some of the lower branches in the canopy may have some effect on Mexican spotted owl foraging. Mexican spotted owls utilize the "perch and pounce" method of hunting, using the lower branches of trees for perching. The loss of some perching sites when burning within prescription is not expected to significantly affect the ability of Mexican spotted owl to forage successfully.

The Mexican spotted owl Recovery Plan encourages fire management programs that take an active role in fuels management and understand the ecological role of fire. The Mexican spotted owl Recovery Plan also recognizes that catastrophic wildfire is one of the primary threats to the owl. Therefore, fire plays the dual role of being both potentially beneficial and catastrophic to the owl and its habitat. The FWS stresses the need to apply adaptive management when using fire. Prescriptions that maintain key structural features of owl and small prey habitats should be developed and tested. These features include large trees, snags, logs, and overstory. Treatments to produce or maintain such habitat components must be assessed by monitoring to evaluate if treatment objectives were met in both the short and long term. Wholesale use of fire without understanding or monitoring its effects on habitat may render these areas unusable by owls, and may also miss opportunities to improve our knowledge of fire effects on these habitats (Moir *et al.* 1995). In regard to managed natural fire in the Kachina Burn Plan, the Coconino National Forest committed to protecting 80-90 percent of the downed logs 12 inches diameter at breast height (dbh) and greater, and to hand-lining snags 18 inches dbh and greater for all managed natural fire actions within Mexican spotted owl protected and restricted habitat as defined by the Mexican spotted owl Recovery Plan (FWS 1995b). These protective measures will assist in maintaining these important components of Mexican spotted owl prey habitat.

The Mexican spotted owl Recovery Plan recognizes that managed natural fire may be beneficial to owl habitat in several ways: (1) it can aid in reducing fuel loads and the risk of catastrophic wildfire which may result in the loss of habitat over large areas; (2) it can create a diverse landscape with considerable horizontal heterogeneity which seems to be relatively characteristic of many areas occupied by spotted owls and also provides for a diverse prey base; and (3) it can create conditions that maintain shade-intolerant species in the landscape.

Prescribed fire should be used carefully in owl habitat (FWS 1995b). Fire is one of the most rapidly acting of natural disturbances. A crown fire can quickly consume vast tracts of forested habitat. After a large crown fire, habitat components for Mexican spotted owl nesting, roosting, and foraging are reduced or eliminated. Small-scale natural fires and prescribed burns, however, can reduce fuel loadings and create small openings and thinned stands that increase horizontal diversity and reduce the spread of catastrophic fire. Small-scale fires and lightning strikes also create snags, canopy gaps, and large downed logs, plus they perpetuate understory shrubs, grasses, and forbs which are important habitat components to the owl and its prey (Moir *et al.* 1995).

The Mexican spotted owl Recovery Plan states that the nest site should be known before burning occurs in the PAC, as this information is needed to determine the location of the 100-acre activity center and protect it from fire. The most accurate, up-to-date information needs to be used to determine 100-acre activity centers before prescribed or managed natural fire is allowed to burn in PACs. FWS policy is to consider PACs occupied each breeding season.

The following summarizes recommendations from the Mexican Spotted Owl Recovery Plan in regard to prescribed fire in PACs:

1. Experimentally treat (prescribed fire and fuels management) 10 percent of PACs within each recovery unit that exhibits high fire risk conditions (use of prescribed fire without mechanical treatments is not limited, except within the 100-acre nest site).

2. Treatments should retain or enhance owl habitat components.

3. Treatments should only occur during the non-breeding season (September 1 to February 28).

4. A 100-acre area around the known nest site is to be excluded from treatments.

5. Effects of treatments on the owl, prey species, and their habitats should be assessed.

If such effects are not negative, an additional sample of PACs can be treated. If negative effects are detected, measures should be developed to ameliorate those effects. If effects cannot be mitigated, no additional treatments should be permitted.

The Recovery Plan finds that catastrophic wildfire is a primary threat to the species. In some areas of the Huachuca Mountains prescribed fire or fuels treatment is necessary to avoid occurrence of a stand-replacing fire that would be highly deleterious to spotted owl habitat. Where the risk of stand-replacing fire is high in the Huachuca Mountains, the benefits of treatments to reduce that risk are likely to outweigh possible direct adverse effects of such treatments on the owl or its habitat.

The Fort has adopted the recommendations of the Mexican spotted owl Recovery Plan in regard to prescribed fire, managed natural fire, and fuel treatments, with some modifications as suggested by the FWS (see the Description of the Proposed Conservation Measures of this biological opinion). Commitments include not burning within the 100-acre core areas, not removing trees larger than 9 inches dbh in PACs, enhancement or retainment of owl habitat components during treatments, limiting prescribed or managed natural fire treatments within PACs to 100 acres at a time and only outside of the breeding season, and other measures as described in the Description of the Proposed Conservation. Although fire is an imprecise tool, these measures greatly reduce the likelihood that treatments will damage Mexican spotted owl habitat or result in death of Mexican spotted owls. Properly applied, a fire program should provide long term protection of owl habitat from catastrophic wildfire.

Table 17 in the Revised PBA describes funding for monitoring of threatened and endangered species. It is our assumption that such monitoring will continue under extant methodologies, with opportunity for revision during annual coordination meetings. It shall be noted that surveys for Mexican spotted owl require permits form both the FWS and AGFD.

- Effects to critical habitat are similar to those described for nominal Mexican spotted owl critical habitat, above. Again, stand-replacing fire is most likely the greatest threat to critical habitat on Fort Huachuca. Fort Huachuca's proposed action includes both efforts to reduce the risk of catastrophic wildfire and to minimize the effects of fire suppression.

The proposed action is not anticipated to: (1) change the distribution of tree species and sizes within critical habitat; (2) reduce canopy shade below 40 percent of the ground; or (3) appreciably reduce the number of snags. The proposed action is also anticipated to retain: (1) high volumes of fallen trees and other woody debris; (2) a wide range of tree and plant species, including hardwoods; (3) and adequate levels of residual plant cover to maintain fruits and seeds, and allow plant regeneration.

Cumulative Effects

See the Cumulative Effects section for the Huachuca water umbel, above, for a general description of cumulative effects and a discussion of analysis of those effects per Section 321 of the Defense Authorization Act of 2004.

Cumulative effects within the portion of the action area within which Mexican spotted owl occur are limited. UDA traffic occurs throughout the Huachuca Mountains, including on Fort Huachuca, and it is likely that individuals and groups of individuals have crossed PACs and disturbed Mexican spotted owls. The presence of UDAs is also anticipated to increase the risk of wildfire. Interdiction of UDAs by Federal authorities is not a cumulative effect.

Population growth in the Sierra Vista area and the popularity of the area as a recreational destination is resulting in increased human use of Mexican spotted owl habitat in the Huachuca Mountains. In addition, private lands at the mouths of many canyons to the south of Fort Huachuca are being developed as housing tracts or ranchettes. The lower reaches of these canyons may provide wintering spotted owl habitat. This increasing human presence is likely to result in increased disturbance of Mexican spotted that ordinarily reside on Fort Huachuca. The effects of this development, however, are not considered cumulative to proposed action because they do not occur within the action area. Compliance with the Act for activities on state and private lands that may affect the Mexican spotted owl, but are not addressed by section 7 consultation, could occur through section 10(a)(1)(B) of the Act.

Conclusion

We reviewed the current status of the Mexican spotted owl, the environmental baseline for the action area, and the effects of the proposed action. We could not consider cumulative effects in our conclusion pursuant to Section 321 of the Defense Authorization Act of 2004. It is our biological opinion that the proposed action is not likely to jeopardize the species or adversely modify or destroy critical habitat. In making our determination we considered the following:

- Mexican spotted owls at Fort Huachuca occur primarily in remote canyons of the Huachuca Mountains that few recreationists visit (an exception being Scheelite Canyon) and where little or no military training occurs.

- Few military overflights occur in the canyons of the Huachuca Mountains where spotted owls are located, and most flights occur above 500 feet AGL.

- Recreational rock climbing and rapelling are prohibited at Fort Huachuca. Rapelling as part of military training is restricted to a cliff in Garden Canyon, which is outside of known owl PACs.

- The threat of wildfire is being addressed by the Fort through a comprehensive fire management plan that calls for prescribed fire and reduction of fuel loads. Implementation of the plan will help reduce the chance of catastrophic stand-replacing fire that could adversely affect owl nesting and foraging habitat.

- The proposed action affects a relatively small part of the range and total critical habitat of this threatened species.

- The Fort proposes substantial conservation measures, including specific measures contained in the Mexican spotted owl Recovery Plan, that reduce the effects of the proposed action on the species and to the Primary Constituent Elements of critical habitat.

- The aforementioned effects will not affect the ability to recover the Mexican spotted owl.

- Monitoring will be performed to verify the status of the species within the action area and to evaluate the effectiveness of the conservation measures, both in minimizing the effects of the proposed action and in retaining the primary constituent elements of critical habitat.

INCIDENTAL TAKE STATEMENT

Please see the Incidental Take Statement for the southwestern willow flycatcher, above, for a narrative and the statute and policy governing the content of this Incidental Take Statement.

Under the terms of sections 7(b)(4) and 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are non-discretionary, and must be undertaken by Fort Huachuca so that they become binding conditions of any grant or permit issued to the applicant, as appropriate, for the exemption in section 7(o)(2) to apply. Fort Huachuca has a continuing duty to regulate the activity covered by this incidental take statement. If Fort Huachuca: (1) fails to assume and implement the terms and conditions; or (2) fails to require the applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, Fort Huachuca must report the progress of the action and its impact on the species to the FWS as specified in the incidental take statement (50 CFR §402.14(i)(3)).

Amount or Extent of the Take

Take may be in the form of harm, harassment, injury, or death resulting from the loss of a nesting site, loss or disturbance of a nest by recreational or military activities, loss or degradation of foraging habitat as a result of fire, and collision of a Mexican spotted owl with a vehicle, antennae, fences, or other project features. The FWS anticipates incidental take of Mexican spotted owl will be difficult to detect or determine. The Fort's proposed conservation measures

greatly reduce the chance that take would occur; however, we anticipate the take, through direct injury or mortality, or harm of a total of two Mexican spotted owls, or one nest with eggs or nestlings as a result of the above causes over the life of the project at Fort Huachuca.

Additionally, take of one Mexican spotted owl is anticipated in the Scheelite Canyon PAC and one Mexican spotted owl elsewhere at Fort Huachuca over the life of the project as a result of harassment due primarily to recreational activities, but also possibly as a result of other causes listed above.

This biological opinion does not authorize any form of take not incidental to implementation of the proposed action as described in this biological opinion and the Revised PBA.

Effect of the Take

We have determined that the level of anticipated take is not likely to jeopardize the continued existence of the Mexican spotted owl because it represents a small proportion of the species' population within the recovery unit and a yet-smaller proportion of the greater population. We have also determined that the level of anticipated take will not destroy or adversely modify designated critical habitat because the take is in the form of mortality and harm resulting from habitat alterations that are small in relation to the amount of critical habitat in the recovery unit and rangewide. We will not refer the incidental take of Mexican spotted owl for prosecution under the Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. §§703-712), if such take is in compliance with the terms and conditions (including amount and/or number) specified herein.

Reasonable and Prudent Measures

The FWS believes that no reasonable and prudent measures are necessary because the conservation measures proposed by Fort Huachuca include all possible measures, including many contained in the Mexican spotted owl Recovery Plan, to minimize impacts of incidental take of the species. Therefore, because there are no reasonable and prudent measures, there are no terms and conditions.

If the incidental take anticipated in the paragraph entitled "Amount or Extent of Take is met, the Fort shall immediately notify the FWS in writing. If, during the course of the action, the level of anticipated incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation. In the interim, the Fort must cease the activity resulting in the take if it is determined that the impact of additional taking will cause an irreversible and adverse impact on the species. Fort Huachuca must immediately provide an explanation of the causes of the taking and review with the FWS the need for possible modification of the reasonable and prudent measures.

Conservation Recommendations

See the Conservation Recommendations section for the Huachuca water umbel, above, for information regarding the statute and policy governing Fort Huachuca's implementation of the following recommendations:

1. Fort Huachuca should study the effects of recreational activity on Mexican spotted owls and their habitat in Scheelite Canyon. The study should quantify recreational use, effects on owl behavior, energetics, movements, and reproduction, as well as effects to the habitat resulting from trampling, potential for fire, etc.

For the FWS to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitat, the FWS requests notification of the implementation of any conservation recommendations.

Effects of the Proposed Action - Lesser Long-Nosed Bat

Effects of the proposed action that may affect the lesser long-nosed bat include fire, noise, habitat loss, direct mortality, and human disturbance.

The lesser long-nosed bat is most sensitive to activities that might adversely affect roost sites, particularly recreational caving. Other elements of the proposed action may affect foraging habitat or foraging bats, including fire ignited by ordnance, recreationists or other human activities; prescribed or managed natural fire; noise from aircraft or weapons firing; collisions of bats with vehicles, powerlines, wind turbines and other project features; grazing by horses; construction activities that might result in mortality of forage plants; and individual agaves that may be damaged directly by ordnance or by bivouacs or other training activities.

Effects of Human Disturbance

Roosting lesser long-nosed bats are very sensitive to human intrusion. Recreational cavers entering Manila Mine, Pyeatt Cave, or other sites where lesser long-nosed bats might day roost could result in temporary or permanent desertion of the roost. However, Manila Mine and Pyeatt Cave (where lesser long-nosed bats have been confirmed), as well as upper Pyeatt Cave (potential habitat) are closed while the LLNB is present (minimum July 1 through October 31). The Fort protects the entrances of these roosts with chain link fence (but the bats can still get through), the entrances are posted, the access roads to Manila Mine and Pyeatt Cave are gated and locked seasonally, the road to Upper Pyeatt Cave is rough and little used, and a live video surveillance system alerts the Fort of illegal entry. Thus, the Fort has taken many precautions to ensure that the bats are not disturbed. Disturbance of known roost sites appears to be minimal. Hunting is allowed in the vicinity of the three known lesser long-nosed bat roosts. Potentially, a hunter could discharge a weapon near a roost site and disturb bats or cause them to temporarily abandon the roost. However, this type of disturbance is likely to be infrequent, and most hunting occurs after the bats have left in the fall.

Some training activities, such as bivouacs, ordnance delivery, and other activities that may result in disturbance could damage or destroy agaves, or result in soil compaction and reduced agave establishment. However, personnel are instructed to avoid disturbance to agaves, nearly all such training occurs at established sites or previously disturbed areas, areas directly disturbed by ordnance delivery are relatively small, and the most significant stands of Palmer's agave are designated as Agave Management Areas and protected from training activities. Very little training occurs in the habitat of Parry's agave (i.e., at higher elevations).

Effects of fire on the various components of the proposed action, prescribed or managed fire and wildfire suppression have the greatest potential to adversely affect agaves and forage plant availability. It appears that forage resources are not limiting to lesser long-nosed bat populations in the Huachuca Mountains, or at least it is unlikely (Steidl 2001). Liz Slauson, working at several sites in southeastern Arizona, has never observed agave flowers drained of nectar, suggesting nectar availability is not limiting. However, the bats fly south in September or October at a time when blooming agaves are becoming less and less abundant, suggesting a waning food supply may be one of the factors that triggers migration. Yar Petryszyn (pers. comm. 1999 as cited in the Revised PBA) has observed apparent antagonistic behavior of bats at agave flowers late in the season, suggesting possible competition for resources. If forage resources are limiting at times or certain places, we would expect that in some years or some areas, numbers of bats may be reduced, or bats may have to fly farther from their roosts to obtain sufficient resources, as a result of insufficient blooming agaves. Bats that fly greater distances are probably more vulnerable to predation or accidental death. Under a scenario of limiting food resources, damage or death of agaves due to prescribed fire could conceivably further reduce forage resources and bat numbers. Although there is some uncertainty whether agaves are limiting to lesser long-nosed bats in the project area, it seems likely that landscape-scale projects, such as a prescribed fire, that are adjacent to important roosts will probably have some effects on bat foraging behavior, and some of these are likely to be adverse effects. The FWS considers loss of forage resources a great enough threat to include protection of foraging areas and food plants as a priority 1 task in the lesser long-nosed bat recovery plan, though information such as that provided by Steidl (2001) and others have resulted in an informal, *post hoc* reprioritization of this task.

Mortality of leaf succulents exposed to fire is extremely variable. The Baker prescribed fire was conducted recently in the southern Peloncillo Mountains in extreme southeastern Arizona and southwestern New Mexico. According to preliminary monitoring efforts conducted after the fire, there was seven to 11 percent mortality of Palmer's agaves exposed to fire (Peter Warren, pers. comm. 1997 as cited in the Revised PBA). Additional mortality may accrue through loss of the smallest and least detectable size classes of agave. On the Maverick Prescribed Fire, also in the Peloncillo Mountains, less than 5 percent of agaves in burned areas were killed by the fire. Because of a mosaic of burned and unburned areas, overall mortality in the project area was perhaps less than 1 percent (T. Roller, pers. comm. 1998 as cited in the Revised PBA). Thomas and Goodson (1992) reported an average mortality of 28 percent of five species of leaf succulents from nine burned sites in southern Arizona. Palmer's agave mortality averaged 18 percent. However, post-fire grazing may have influenced reported mortality. Concentrations of paniculate agaves are primarily on the rocky, shallow soils of hills and ridges, particularly on southerly and southeasterly facing slopes. Other Palmer's and Parry's agaves are found scattered in areas of deep, heavy soils where thick stands of shrubs and mesquite form heavy fuel loads. The relative fuel loading and potential exposure of agaves to intense fire is lower on rocky soils.

Agave mortality due to fire may affect the abundance and distribution of blooming agaves on the landscape for many years into the future, especially if there is high mortality within certain age/size classes (e.g., seedlings). In addition, natural recruitment of agaves may be very episodic, and the effects of fire on the agave seed bank in the soil are unknown. Often one of the objectives of prescribed fire is to increase abundance of grasses. Grasses are probably one of the strongest competitors with agave seedlings (Tony Burgess, pers. comm. 1997 as cited in the Revised PBA). Increased abundance of grass could result in reduced agave abundance. Agave

stalks, as they begin to bolt, are particularly palatable to domestic livestock and wild herbivores, including deer, javelina, rodents, and rabbits (Michelle Hawks, University of Arizona, Tucson, pers. comm. 1997 as cited in the Revised PBA; Wendy Hodgson, pers. comm. 1997 as cited in the Revised PBA). Because agaves often remain partially green, succulent, and available to herbivores when food resources are low immediately following a fire, they may be preferentially selected by herbivores. This may in turn affect the availability of agave flowering stalks to bats.

Besides direct mortality of agaves, fire may alter the availability of blooming agaves. By early spring, an agave plant would have physiologically committed to bolt (send up a flowering stalk). If the plant is burned and lives, bolting continues, though the flower stalk is smaller with fewer flowers (Howell 1996; Liz Slauson, pers. comm. 1997 as cited in the Revised PBA). If the stalk burns directly, the reproductive effort of that plant and the availability of flowers and nectar to Leptonycteris have been lost. A fire may actually stimulate flowering in adult agaves one to two years following a burn (Liz Slauson pers. comm. 1997 as cited in the Revised PBA). However, in subsequent years following the period of increased flowering there may be a reduced number of flowering agaves. Although the availability of blooming agaves may be affected by fire, the nectar production and sugar content of surviving plants is little effected. Working in the Peloncillo Mountains, Slauson (pers. comm. 1997 as cited in the Revised PBA) found that nectar production and sugar content did not differ between unburned agaves and burned agaves that did not have greater than 80-90 percent of the leaf area burned. The complexity of variables influencing agave flowering may mask the effects of a burn on agave flowering within several years of a fire.

Reintroducing fire into fire-adapted communities, such as desert grassland and oak/juniper savanna systems, can also have many benefits and may improve overall long-term "ecosystem management" objectives. Among these is the reduction of woody fuels resulting in decreased probability of intense fires and resulting erosion, soil sterilization, and increased plant mortality. Ultimately, if fire continues to be excluded from fire-adapted systems, a major wildfire will occur with potentially devastating effects. Returning to a more natural regime of low-intensity fires would help to maintain a mosaic of grasslands, woodlands, and shrublands across the landscape and may enhance refugia in which fuel loads and the chances of damaging fires are low. However, even under a prescribed fire regime there are potential adverse effects of fire to forage plants that may affect resource availability for the lesser long-nosed bat.

Activities that directly or indirectly promote invasion or increased density of nonnative grasses, particularly Lehmann lovegrass, may result in increased fire frequency or intensity, reduced densities of Palmer's agave, and thus reduced forage resources for the lesser long-nosed bat. Lehmann lovegrass is abundant in some portions of the West and South ranges at Fort Huachuca. This species increases after fire (Ruyle *et al.* 1988, Sumrall *et al.* 1991, Martin 1983, Howell 1996), but also produces an abundance of fine fuel that promotes hot fires (McPherson 1995). Thus, frequent fire is likely to increase the abundance of Lehmann lovegrass, and increased abundance of this grass will likely fuel more fires and hotter fires, creating a positive feedback loop (Anable *et al.* 1992). Frequent, hot fires brought about by prescribed fires and increasing prevalence of Lehmann lovegrass will likely reduce densities of Palmer's agave. Howell (1996) found that Lehmann lovegrass creates areas of continuous fuels at Fort Huachuca that burn at a constant temperature versus stands of native grasses that are patchy in regard to fuels and fire intensity. Agaves can persist in fire-prone native grasslands in bare areas or refugia that burn lightly or not at all. Such refugia are less common in Lehmann lovegrass stands. Howell (1996)

also noted a negative relationship between the proportion of agave seedlings and ramets and the amount of Lehmann lovegrass. She suggested that Lehmann lovegrass appears to suppress agave recruitment independent of the fire effects just described. The mechanism of suppression is unclear, but Howell (1996) suggests Lehmann lovegrass may compete effectively with agaves for nutrients and/or light. If agave densities are reduced due to elevated fire effects or recruitment suppression caused by Lehmann lovegrass invasion, forage resources of the lesser long-nosed bat will be reduced.

Howell (1996) found that a fire frequency of three to six per decade on the South Range is "clearly too high to allow sexual reproduction to persist in the agave community...too high to permit seedling establishment and too high to allow even the fast growing clones to achieve reproductive status." Howell (1996) suggested that fires be managed on the South Range to approximate the natural fire frequency, which is likely 10-15 years (8-22 years range). She also recommended suppressing fires in plots with demography biased towards young and/or middle age class agaves, because of their sensitivity to fire damage. Examination of Figure 32 reveals that some areas of the South Range, and fewer areas on the West Range, burned four or more times from 1973-2002, which is, according to Howell (1996), too often for healthy agave stands. Most of the West Range, and large portions of the eastern and southern parts of the South Range burned at approximately the 10-15 year frequency recommended by Howell (1996). As discussed, the relationship of fire frequency and intensity to agave population dynamics is complex. The FWS recommends adaptive management in regard to fire management to ensure maintenance of viable, healthy agave populations. The Fort has several conservation measures that will reduce the effect of fire on agave (see the Fire Management, Integrated Training Area Management, and Agave Management Plan subsections in the Description of the Proposed Conservation Measures of this biological opinion). One of these is the suppression of fires in agave management areas unless the area is approaching its natural fire return interval of 10 years.

The importance of Parry's agave stands in the Huachuca Mountains as a forage resource for the lesser long-nosed bat is unknown. As discussed, Parry's agave generally occurs at higher elevation than Palmer's agave, and occurs in forest openings throughout the Huachuca Mountains to the mountain's crest. Benson and Darrow (1982) note that it typically flowers in June and early July, which is before the lesser long-nosed bat arrives at roosts at Fort Huachuca. However, J. Rorabaugh (pers. comm. 1998 as cited in the Revised PBA) noted many Parry's agave in flower high in the Huachuca Mountains on the crest trail during late July in 1997. It may be that agaves at high elevation bloom later than at lower sites, and could potentially be blooming and be used as a forage resource when lesser long-nosed bats arrive in July or early August.

The only significant threat to stands of agaves in the forested portions of the Huachuca Mountains is fire. As discussed for the Huachuca water umbel and Mexican spotted owl, fuel loads are high in some portions of the Huachuca Mountains, and a stand-replacing, catastrophic wildfire could occur due to lightning strikes or project-related causes such as recreational use or ordnance. Because Parry's agave occurs primarily in openings and often on rocky slopes where fuel loads are relatively light, agave populations may not be severely directly affected by wildfire. Openings created by fire could conceivably increase habitat for agaves, temporarily. However, post-fire erosion of slopes could bury or scour hillsides and rocky places where agaves occur. The Fort has implemented an Integrated Wildland Fire Management Plan to reduce fuel loads and the chance of catastrophic fire in the Huachuca Mountains. With implementation of this plan, threats to agave populations posed by wildfire will be reduced.

Implementation of Fort Huachuca's revised Agave Management Plan (Appendix D in the revised PBA), as proposed by the Fort (see Agave Management Plan subsection of the Description of the Proposed Conservation Measures of this biological opinion and Appendix D of the Revised PBA), would provide good protection for key agave stands and bat foraging areas in the lower elevation areas of Fort Huachuca. The plan provides for minimizing or eliminating possible adverse effects of training activities, provides a means for fire to play a more natural role without inhibiting agave population health or viability, and sets up an administrative network and environmental education programs to ensure that protective measures are carried out. However, some flexibility should be built into the plan, and the recommendation to apply prescribed fire only from November through March in the agave management areas may not be necessary to maintain healthy and viable agave populations. As demonstrated in the Baker and Maverick fires in the Peloncillo Mountains, warm season fire may not result in significant mortality. Exclusion of fire during the warm season could encourage invasion of woody species. However, cool season burns may be warranted to protect small size classes of agaves, particularly if Lehmann lovegrass is present, which could increase fire intensity. As discussed, due to uncertainties and the need to make changes as monitoring data and new research results become available, Fort Huachuca will use an adaptive management approach in which management of key agave stands would evolve with new information.

Effects of Noise

Howell (1992) examined the effects of UAS (Sky Owl and Hunter) testing on the lesser long-nosed bat at Fort Huachuca. Fort Huachuca proposes testing of the Pioneer and Hunter UAS; the Pioneer and Sky Owl are both relatively small UAS and very similar in regard to noise output. Howell (1992) concluded that lesser long-nosed bats would not hear noise of UAS cruising at 1,000 to 3,000 feet agl. Currently, typical cruising elevation is above 3,500 feet agl, with some flights as low as 1,000 feet. Noise generated by UAS is relatively low intensity. Also, lesser long-nosed bats are not very sensitive to sounds below frequencies of 10 kHz (Howell 1974). The high frequency sounds to which the bat is sensitive attenuate very rapidly with distance (Howell 1992). Thus, noise generated by typical UAS flights over Fort Huachuca, to the Canelo Hills, the Altar Valley, or other destinations should not disturb foraging or roosting lesser long-nosed bats.

Most proposed UAS take-offs and landings would occur on the Pioneer and Rugge-Hamilton airstrips at the Black Tower Complex on the West Range, but occasional take-off and landings would occur at the Hubbard airstrip. The Hunter UAS is flown primarily from the Rugge-Hamilton strip; the smaller Shadow UAS uses the Rugge Hamilton, Pioneer strip and Hubbard Airstrip when NET training is being conducted. Howell (1992) concluded that UAS take-off at Hubbard airstrip would not affect lesser long-nosed bats because agaves are scarce to non-existent in that area and the airstrip is over nine miles from known roosts. However, good stands of agaves are present near the Black Tower UAS facility, and bats probably forage near the facility. The UAS Training Battalion does not conduct Rocket Assisted Take Off (RATO) operations. The Fort has adopted policies calling for nocturnal flights of UAS to be above 500 feet from July 1 to October 31, and take-off and landing approaches at Rugge-Hamilton and Pioneer airstrips would be modified to avoid flying low-level over agave management areas.

Disturbance of bats as a result of noise could also occur due to low-level fixed-wing and helicopter flights, small arms or other weapons fire associated with military training, or discharge of a firearm by a hunter. Dalton and Dalton (1993) investigated the effects of low-level (500 feet agl) military jet flights on the lesser long-nosed bat in a mine that served as a day roost at Organ Pipe Cactus National Monument. Bats exposed to low-level flights exhibited no acute responses (panic flights, falling young bats, or startle responses). No significant differences in bat orienting responses were noted before, during, or after jet flights, but depressed levels of bat flights were noted for up to 30 minutes following the jet noise. Low-level jet noise attenuated rapidly within the roost, particularly the high frequency sounds to which bats are particularly sensitive. The authors note that extrapolation of the results to other sites with different terrain or mine tunnel geometry may not be valid. They also find that the study did not address any potential long-term effects to the bat colony. As discussed previously, wildlife typically respond more to helicopter flights than fixed-wing aircraft. A helicopter flying very low over a bat roost could produce noise as well as high winds that could disturb bats.

The findings of Dalton and Dalton (1993) combined with the apparent infrequency of low-level flights at Fort Huachuca suggest that noise from overflights probably does not significantly adversely affect lesser long-nosed bats that are roosting deep in a mine or cave, at least in the short-term. Low-level nocturnal military flights may affect bats that are foraging or night roosting differently, and as Dalton and Dalton (1993) note, the long-term effects of repeated low-level flights are unknown. Again, however, the infrequency of low-level flights at Fort Huachuca reduces the probability of this being a significant adverse effect.

Noise from military weapons fire is unlikely to disturb lesser long-nosed bats. Small arms firing would occur on the South Range; however, the firing ranges are all at least five miles from Pyeatt Cave and Manila Mine, and over three miles from Wren Bridge. Noise from weapons fire would attenuate dramatically over that distance, particularly the high frequencies. Artillery and mortar firing occurs at several areas on the East Range. Ordnance is directed eastward from these sites and is delivered into Impact Area Zulu, also on the East Range. Noise from these sources is louder than the small arms firing on the West Range. However, mortar and artillery firing on the East Range occur at a much greater distance from the known bat roosts. All mortar and artillery firing sites and the impact zone in Impact Area Zulu are more than six miles from Wren Bridge and more than 7 miles from Pyeatt Cave and Manila Mine. No effects to lesser long-nosed bats are anticipated as a result of mortar and artillery firing on the East Range.

Effects of Direct Mortality

Mortality or injury of lesser long-nosed bats could also occur due to collisions with vehicles, aircraft, ordnance, power/communications lines, wind turbines, antennas, or other project features on Fort Huachuca. The frequency of such collisions is unknown, but the potential exists for bats to collide with such features. The Fort has proposed no nighttime training in agave management areas from July 1 through October 31, no nighttime use and no tracer fire on live fire ranges 2, 3, and 4 from July 1 through October 31, no use of pyrotechnics within 0.25 mile of agave management areas, and no off-road vehicle use. Restrictions on low-level flights have also been implemented. Collectively, these measures greatly reduce the likelihood of collisions (see the Description of the Proposed Conservation Measures of this biological opinion).

Effects of Habitat Loss

UAVs crash on or off-post approximately once per year. There have also been two manned aircraft crashes at Fort Huachuca (at Libby Airfield) in the past ten years. Search and rescue operations are carried out for manned aircraft that crash, and aerial or ground searches occur following crashes of UAVs. Some potential exists for aircraft crashes to directly impact agaves or to start fires that affect agaves. The potential for a crash to directly affect a roost site on or off-post is remote.

Predation of agaves by gophers and ungulates on the West Range was found to be inhibiting sexual reproduction of agaves. Howell (1996) suggested that if areas of the West Range are to be managed for agaves "attention will have to be paid to the intense predation." Predator control (coyotes and other carnivores) was carried out on the South Range in the 1980's and early 1990s' in an attempt to increase populations of Chihuahuan pronghorn. Reduced predator densities could theoretically contribute to increased populations of gophers and ungulates that in turn result in increased predation of agaves. However, Howell (1996) found no correlation between predator control activities and agave demographics on the West versus the South ranges, and predation of agaves appeared to be higher on the West Range where predator control has not been implemented. Fort Huachuca no longer carries out any predator control activities.

Cattle grazing can adversely affect agave survivorship and bolting. Prior to the summer monsoons at Four Peaks on Tonto National Forest, cattle were observed eating the unprotected apex of several agave plants (Tricia Roller, FWS, Tucson, AZ pers. comm. 1997 as cited in the Revised PBA). Cattle probably trample young agaves, as well. Although cattle have been excluded from Fort Huachuca for many years, grazing by horses occurs on 1,433 acres of the West Range within 0.6 mile of protected agave stands and Wren Bridge. The horse pastures are approximately three miles from Manila Mine and Pyeatt Cave. Thus, the grazed area is likely foraging habitat for the lesser long-nosed bat. There are some differences in grazing behavior between horses and cattle. It is unknown whether horses browse agave bolts, but if they do, forage resource availability for the bat would be reduced by such browsing. Horses, like cattle, probably also trample young agaves and may compact soils and reduce germination and survival. Although horses tend to avoid areas of high densities of agaves (Howell and Robinett 1995), any trampling or browsing of agaves would reduce forage resources available to the lesser long-nosed bat. Direct effects due to grazing may be more intense in areas grazed during the flowering season of agave and where horses congregate near water sources.

The Fort proposes a number of building/construction projects over the next 10 years (Table 3). Most of these would occur in the cantonment area in previously disturbed areas, or would constitute improvements to existing structures. Few, if any, of these projects have potential to disturb habitats that may contain agaves. An exception may be the RV park expansion on the northwestern side of the cantonment area. However, the expansion is small, and any effects to bat forage resources at Fort Huachuca would be relatively very small. The Fort is also proposing to build a new Ammunition Supply Point (ASP) in 2011. The project would disturb approximately 25 acres of grassland on the south range where few, if any, agave are known to occur. The Fort has adopted conservation measures to ensure minimal disturbance of lesser long-nosed bat foraging habitat during construction activities (see the Description of the Proposed Conservation Measures of this biological opinion).

Fort Huachuca has the authority to exchange, acquire, or dispose of lands to benefit their mission. The Fort has the authority to exchange a 26-acre parcel near Kayetan Drive and Buffalo Soldier Trial to the Arizona State Land Department for state in-holdings on the East Range. This exchange was authorized by special Federal legislation in 1987. If all or part of the 26-acre parcel is developed, some foraging habitat of the bat could be lost. It is unknown whether agaves occur on the parcel, but it is rather low on the bajada where agaves are uncommon or absent.

A related land exchange is pending to gain full title to nine parcels of State of Arizona land on the East Range of the Fort. In cooperation with the BLM and the State of Arizona, state trust lands will be exchanged to ensure that full title to those parcels is conveyed to the Federal government. This exchange was authorized by special Federal legislation in 2000. This administrative action will not change land use or activities on those inholdings.

For numerous years, the City of Sierra Vista has sought to acquire an additional 203 acres from Fort Huachuca adjacent to Libby Army Airfield (LAAF) pursuant to the Airport Improvement Act (AIA) to be used for aviation-related uses. The City has previously acquired 72 acres under the AIA to establish a civilian municipal airport adjacent to LAAF. In June 2002 Fort Huachuca set aside further consideration of this transfer to the City of Sierra Vista (see Appendix D of the Revised PBA). An alternative to conveyance is currently being considered by the Fort, i.e., a leasing action. If either realty action is proposed in the future it will undergo a separate section 7 consultation.

Off-post activities are unlikely to affect lesser long-nosed bats or their habitat. These activities occur in previously-disturbed areas and, therefore, should have little effect on agaves. As discussed for the southwestern willow flycatcher, activities off-post could potentially increase the chances of fire, which may adversely affect agave plants and bat forage resources. However, the Fort has several conservation measures in place to reduce the chance of this occurring (see the Description of the Proposed Conservation Measures of this biological opinion).

Effects of Interrelated and Interdependent Actions

As discussed for the Huachuca water umbel and the southwestern willow flycatcher, some of the existing development and population in the Sierra Vista area can be attributed to Fort Huachuca, because some employees, contractors, military dependents, military retirees, and others live in the Sierra Vista area because of job opportunities or military benefits provided by the Fort. Thus, some of the residents and development off-post would not be there but for the presence of Fort Huachuca. Some of this development may result in destruction of lesser long-nosed bat foraging habitat. However, the best agave populations appear to be concentrated on the upper bajadas, while most of the development has occurred lower on the slope where agaves are uncommon. Also, as discussed previously, predicted growth in the Sierra Vista area has achieved a momentum that is separate from any influence Fort Huachuca might have.

Table 17 in the Revised PBA describes funding for monitoring of threatened and endangered species. It is our assumption that such monitoring will continue under extant methodologies, with opportunity for revision during annual coordination meetings. It shall be noted that surveys for lesser long-nosed bats require permits form both the FWS and AGFD.

Cumulative Effects

See the Cumulative Effects section for the Huachuca water umbel, above, for a general description of cumulative effects and a discussion of analysis of those effects per Section 321 of the Defense Authorization Act of 2004.

Much of the land in the project area is managed by Federal agencies, particularly the BLM, Coronado National Forest, and Coronado National Memorial. The only significant known roost in the Huachuca Mountains outside of Fort Huachuca is the State of Texas Mine on the Coronado National Memorial. Activities on state and private lands may require permits or funding from Federal agencies. Thus, many of the actions that are reasonably expected to occur in the project area that may adversely affect the lesser long-nosed bat would be subject to section 7 consultation.

The effects of grazing, development, and other activities occur on large tracts of state and private lands within the project area, as well as recreation and management activities at Kartchner Caverns State Park (i.e. trail construction and removal of live, flowering agave bolts for visitor safety) and within the known range of the lesser long-nosed bat that are not interrelated or interdependent actions of Fort Huachuca and are not otherwise subject to section 7. Development near the base of the Huachuca Mountains or at the mouths of canyons on the east slope south of Fort Huachuca could result in destruction of bat foraging habitat and agaves. The effects of these activities are not, however, considered cumulative to proposed action because they do not occur within the action area. Compliance with the Act for activities on state and private lands that may affect the lesser long-nosed bat, but are not addressed by section 7 consultation, could occur through section 10(a)(1)(B) of the Act.

Conclusion

We reviewed the current status of the lesser long-nosed bat, the environmental baseline for the action area, and the effects of the proposed action. We could not consider cumulative effects in our conclusion pursuant to Section 321 of the Defense Authorization Act of 2004. It is our biological opinion that the proposed action is not likely to jeopardize the species. In making our determination we considered the following:

- For Huachuca's proposed action includes many avoidance, minimization, and conservation measures intended to minimize take of lesser long-nosed bats and offset the direct and indirect impacts of the proposed action on the species and its foraging and roosting habitats.

- The project area in which most activities occur covers a relatively minor portion of the total range of the lesser long-nosed bat.

- Monitoring will be performed to verify the status of the species within the action area and to evaluate the effectiveness of the conservation measures.

- The aforementioned effects will not affect the ability to recover the lesser long-nosed bat.

- Critical habitat has not been designated for the lesser long-nosed bat; thus none will be affected.

INCIDENTAL TAKE STATEMENT

Please see the Incidental Take Statement for the southwestern willow flycatcher, above, for a narrative and the statute and policy governing the content of this Incidental Take Statement.

Under the terms of sections 7(b)(4) and 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are non-discretionary, and must be undertaken by Fort Huachuca so that they become binding conditions of any grant or permit issued to the applicant, as appropriate, for the exemption in section 7(o)(2) to apply. Fort Huachuca has a continuing duty to regulate the activity covered by this incidental take statement. If Fort Huachuca: (1) fails to assume and implement the terms and conditions; or (2) fails to require the applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, Fort Huachuca must report the progress of the action and its impact on the species to the FWS as specified in the incidental take statement (50 CFR §402.14(i)(3)).

Amount or Extent of the Take

We anticipate the following incidental take of lesser long-nosed bats as a result of authorized activities that are part of the proposed action:

1. Six (6) lesser long-nosed bats over the life of the project in the form of direct mortality or injury as a result of collisions with vehicles, aircraft, antennas, fences, and other project features.

2. Twenty (20) lesser long-nosed bats per year as a result of harassment due to noise associated with military training, hunter weapons fire, and military overflights.

3. Ten (10) lesser long-nosed bats over the life of the project as a result of harm due to loss of forage plants due to prescribed fire, wildfire suppression, wildfire caused by authorized activities, grazing by horses as described in the proposed action, construction activities, training, and subsequent development on a 26-acre parcel proposed for exchange.

The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. This biological opinion does not authorize any form of take not incidental to the Fort's proposed action as described herein.

Effect of the Take

In this biological opinion, we find that this level of anticipated take is not likely to jeopardize the continued existence of the lesser long-nosed bat.

Reasonable and Prudent Measures

We believe that the following reasonable and prudent measure is necessary and appropriate to minimize impacts of incidental take authorized by this biological opinion:

1. Fort Huachuca shall continue to monitor the lesser long-nosed bat and its habitat to document levels of take and determine effectiveness of conservation measures.

To be exempt from the prohibitions of section 9 of the Act, Fort Huachuca must comply with the following term and condition in regard to the proposed action. This term and condition implements the reasonable and prudent measure described above. Terms and conditions are nondiscretionary.

1. The following terms and conditions implement reasonable and prudent measure number one:

   1.1. Fort Huachuca shall continue to monitor lesser long-nosed bat populations and forage resources;

   1.2. Fort Huachuca shall prepare an annual report which summarizes the implementation of the proposed action and any incidental take that occurred. The FWS is especially interested in an analysis of the effectiveness of the conservation measures and terms and conditions.

If the incidental take anticipated in the paragraph entitled "Amount or Extent of Take is met, the Fort shall immediately notify the FWS in writing. If, during the course of the action, the level of anticipated incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation. In the interim, the Fort must cease the activity resulting in the take if it is determined that the impact of additional taking will cause an irreversible and adverse impact on the species. Fort Huachuca must immediately provide an explanation of the causes of the taking and review with the FWS the need for possible modification of the reasonable and prudent measures.

Conservation Recommendations

See the Conservation Recommendations section for the Huachuca water umbel, above, for information regarding the statute and policy governing Fort Huachuca's implementation of the following recommendations:

1. The Fort should investigate the importance of Parry's agave as a forage resource for the lesser long-nosed bat.

2. The Fort should continue to investigate the fire ecology of paniculate agaves.

3. The Fort should investigate and monitor the invasion of Lehmann lovegrass at Fort Huachuca and assist other agencies in developing methods for controlling this nonnative grass.

For the FWS to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitat, we request notification of the implementation of any conservation recommendations.

Please note that surveys for lesser long-nosed bats, or other bats, that involve capture or take, require appropriate permits from the FWS and Arizona Game and Fish Department.)

Effects of the Proposed Action - Sonora Tiger Salamander

Potential threats to Sonora tiger salamanders from the proposed action include fire and human disturbance.

Effects of Fire

Fire and fire-related activities associated with the proposed action have the potential to adversely affect the salamander. These include fires ignited by ordnance, recreational users, vehicles, and prescribed fire, managed natural fire, and fire suppression activities.

We are not aware of any studies that evaluated the effects of fire on salamanders. However, fire could potentially result in direct death or injury of salamanders, and reduced habitat quality or quantity. Degradation of watershed condition immediately after fires results in dramatically increased runoff, sedimentation, and debris flow that can scour aquatic habitats in canyon bottoms or bury them in debris (DeBano and Neary 1996). In degraded watersheds, less precipitation is captured and stored, thus perennial aquatic systems downstream may become ephemeral during dry seasons or drought (Rinne and Neary 1996). Fire, whether ignited by a natural or human-caused source, could result in degradation of the immediate watershed around a pond, and result in erosion, sedimentation, and ash flow into the pond. Although effects on salamanders are unknown in salmonid fish, ash and slurry flow into streams can be toxic, and populations of macroinvertebrates (salamander prey species) can be drastically reduced after a fire (Rinne 1996), at least temporarily (Roby and Azuma 1995). Smoke diffusion into water and ash flow can result in high level of phosphorus and nitrogen (Spencer and Hauer 1991) with unknown effects to salamanders. James Petranka (University of North Carolina at Ashville, pers. comm. 1998 as cited in the Revised PBA) notes that fire can be detrimental to plethodontid salamanders by eliminating ground cover and associated invertebrates that are key food sources. Mike Lanoo (Indiana University School of Medicine, Muncie, pers. comm. 1998 as cited in the Revised PBA) has never observed any direct effects to tiger salamanders as a result of summer fires in Indiana prairies, but he has noted reduced invertebrate populations in high sediment habitats that resulted in lower food availability for salamanders. In this case, a red-leg (a bacterial infection) outbreak occurred. Dr. Lanoo suspected that ash flow into a pond could cause the same result.

Siltation of a pond due to erosion and runoff following a fire could eliminate habitat. However, the effects of siltation may also be more subtle. Lefcort *et al.* (1997) examined the effects of silt on growth and metamorphosis of larval mole salamanders, *Ambystoma opaceum* and *A. tigrinum*

tigrinum. Salamanders in silty water grew more slowly, metamorphosed sooner, and were more susceptible to infection by a water mold, *Saprolegnia parasitica*, than salamanders in non-silty water.

Fire effects could occur on or off of Fort Huachuca. A wildfire or prescribed or managed natural fire that escapes prescription could potentially burn onto Coronado National Forest land west of the Fort and affect salamander populations and habitat on the west slope of the Huachuca Mountains and adjacent areas of the San Rafael Valley. The chances of a large regional fire resulting from an ignition at Fort Huachuca during the life of the project is probably low, but high fuel loads in portions of the Huachuca Mountains on post (Danzer *et al.* 1997) and recent large stand-replacing fires in the Huachuca Mountains to the south of Fort Huachuca (Carr Peak fire in 1977, Pat Scott Peak fire in 1983) suggest that such a fire is possible. General Wildlife Services (1999) suggests that the Garden Canyon area "is perhaps primed for a catastrophic fire that could lead to major erosion and debris flow on the mid-elevations of the watershed and possible flooding and channel scouring in the lower drainage." The Fort has committed to implementing its Integrated Wildland Fire Management Plan to reduce the fire risk (see the Description of the Proposed Conservation Measures section of this biological opinion and Appendix N of the Revised PBA).

Fire suppression activities could also affect salamanders or their habitat. Most importantly, during fire suppression helicopters are sometimes used to scoop water from ponds or lakes and then drop that water on the fire. Ponds that are depleted from such operations are often refilled from a nearby large lake or reservoir. Because of the location of upper Garden Canyon Pond at Fort Huachuca and its small size, it is unlikely that a helicopter would attempt to take water from it for fire suppression. However, if that was done, aquatic salamanders could be scooped out of the pond and dropped on the fire. If the pond was refilled from Parker Canyon Lake or one of the impoundments on the Fort, nonnative predaceous fish, bullfrog tadpoles, or *Ambystoma tigrinum mavortium* could be introduced into the pond with deleterious effects. Introduction of *A. t. mavortium* into the range of *A. t. stebbinsi* could be particularly damaging, and once introduced it could spread to other ponds. If fish were introduced into the upper Garden Canyon Pond, they likely would not survive for a long period, because the pond dries periodically.

Effects of Human Disturbance

There are 16 ponds (approximately 32 acres) located on Fort Huachuca (Table 2). Some ponds are known to contain bass, sunfish, catfish, bullfrogs and/or crayfish. Fishing on Fort Huachuca is open to the general public and can be done year round. Fishing requires a state license and Fort Huachuca fishing permit and can only be done during daylight hours. Most fishing occurs at the Lakeside pond. In Arizona, anglers commonly move fish among aquatic sites, either to create new fishing opportunities, or by use of bait fish. The introduction of sunfish, bass, mosquito fish, or catfish could result in elimination of aquatic salamanders from upper Garden Canyon Pond.

Tiger salamanders are commonly moved among sites by anglers and bait collectors. Illegal transport and introductions of salamanders in the San Rafael Valley were documented by Collins and Jones (1987), and as noted above, illegal collection and sale of salamanders has occurred at Fort Huachuca. Salamanders could be collected from upper Garden Canyon Pond by bait collectors. The relatively clear water in the pond facilitates detection and collection. If salamanders were transported to the upper Garden Canyon Pond from ponds elsewhere at Fort

Huachuca or from other locales east of the Huachuca Mountains, these salamanders would likely be *Ambystoma tigrinum mavortium*; which could genetically swamp *A. t. stebbinsi* at upper Garden Canyon Pond and could potentially move down Scotia Canyon to other salamander localities. Transport of salamanders among ponds could also spread the iridovirus that regularly decimates populations in the San Rafael Valley. The disease could also be spread by anglers via waders, tackle or other equipment used at a pond where the disease is present and then using that same wet or muddy equipment at upper Garden Canyon Pond.

Collecting, transporting, or releasing salamanders or live fish, using live bait for fishing, and driving off established roads and through ponds are all prohibited activities at Fort Huachuca. However, an employee of the Fort admitted to collecting and selling tiger salamanders (probably *Ambystoma tigrinum mavortium*) from ponds on the bajada at Fort Huachuca east of the Huachuca Mountains (Jon Snyder, Arizona State University, Tempe, pers. comm. 1998 as cited in the Revised PBA). The Fort has committed to conservation measures to reduce human disturbance to the salamander. These measures include placing boulders around the pond to prevent vehicles from accessing the pond, placing a sign at the pond to make recreational users aware that there is no fishing in upper Garden Canyon Pond and that it is illegal to collect, transport or release salamanders on the installation. With the implementation of conservation measures discussed above, the likelihood of salamander collecting, intentional or unintentional stocking of fish or salamanders at upper Garden Canyon Pond, and spread of disease to the pond by anglers, is probably low. Conservation measures include: (1) transport and release of live salamanders and fish are illegal at Fort Huachuca, thus these activities probably occur infrequently; and (2) fisherman are required to obtain a Fort Huachuca fishing permit and permitted individuals are given a fact sheet that clearly states the capture, transport, or release of live salamanders is strictly prohibited and live fish may not be transported or used as bait on Fort Huachuca. If fish were illegally introduced to upper Garden Canyon Pond, periodic drying of the pond would eliminate them, but perhaps not before the fish had eliminated the aquatic salamanders.

Table 17 in the Revised PBA describes funding for monitoring of threatened and endangered species. It is our assumption that such monitoring will continue under extant methodologies, with opportunity for revision during annual coordination meetings. It shall be noted that surveys for Sonora tiger salamander require permits form both the FWS and AGFD.

Cumulative Effects

See the Cumulative Effects section for the Huachuca water umbel, above, for a general description of cumulative effects and a discussion of analysis of those effects per Section 321 of the Defense Authorization Act of 2004.

The Sonora tiger experiences few cumulative effects in the action area; much of the land in the area is managed by Federal agencies, particularly the Coronado National Forest, Fort Huachuca, and Coronado National Memorial. However, several of the known occupied breeding localities are located on private lands to the west of Fort Huachuca, and others are likely to occur on private lands because only the Federal lands have been surveyed extensively. These private lands are used primarily for grazing, but potentially could be subdivided and developed as ranchettes, or used for other purposes. These actions, however, are not cumulative to the proposed action because they are not within the action area. Compliance with the Act for activities on private

lands that may affect the Sonora tiger salamander, but are not addressed by section 7 consultation, could occur through section 10(a)(1)(B) of the Act.

Conclusion

We reviewed the current status of the Sonora tiger salamander, the environmental baseline for the action area, and the effects of the proposed action. We could not consider cumulative effects in our conclusion pursuant to Section 321 of the Defense Authorization Act of 2004. It is our biological opinion that the proposed action is not likely to jeopardize the species. In making our determination we considered the following:

- Only one of about 50 salamander breeding sites is located at Fort Huachuca.
- Fort Huachuca prohibits off-road vehicle use, transport and release of live fish and salamanders, and has proposed other conservation measures to reduce the threats to the Sonora tiger salamander.
- The threat of wildfire is expected to be reduced through a comprehensive fire management plan that calls for prescribed fire and reduction of fuel loads. Execution of the plan will help reduce the chance of catastrophic stand-replacing fire that could adversely affect salamander habitat on and off-post.
- Monitoring will be performed to verify the status of the species within the action area and to evaluate the effectiveness of the conservation measures.
- The aforementioned effects will not affect the ability to recover the Sonora tiger salamander.
- Critical habitat has not been designated for the Sonora tiger salamander thus, none will be affected.

INCIDENTAL TAKE STATEMENT

Please see the Incidental Take Statement for the southwestern willow flycatcher, above, for a narrative and the statute and policy governing the content of this Incidental Take Statement.

Under the terms of sections 7(b)(4) and 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are non-discretionary, and must be undertaken by Fort Huachuca so that they become binding conditions of any grant or permit issued to the applicant, as appropriate, for the exemption in section 7(o)(2) to apply. Fort Huachuca has a continuing duty to regulate the activity covered by this incidental take statement. If Fort Huachuca: (1) fails to assume and implement the terms and conditions; or (2) fails to require the applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, Fort Huachuca must report the progress of the

action and its impact on the species to the FWS as specified in the incidental take statement (50 CFR §402.14(i)(3)).

Amount or Extent of the Take

Take of Sonora tiger salamander could occur in the form of harm, harassment, injury, or death resulting from: (1) escaped prescribed fire or managed natural fire; and (2) decisions made during fire suppression. The FWS anticipates loss of the entire aquatic population of Sonora tiger salamanders at Upper Garden Canyon Pond once during the life of the project due to the causes above.

The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. This biological opinion does not authorize any form of take not incidental to implementation of the proposed action as described in this opinion and in the Revised PBA.

Effect of the Take

We have determined that the level of anticipated take is not likely to jeopardize the continued existence of the Sonora tiger salamander. If the entire aquatic population at Upper Garden Canyon Pond was lost due to the above causes, the pond would likely be recolonized as terrestrial salamanders returned to the pond to breed.

Reasonable and Prudent Measures

We believe that no reasonable and prudent measures are necessary because the conservation measures proposed by Fort Huachuca include all possible measures to minimize impacts of incidental take of the Sonora tiger salamander. Absent Reasonable and Prudent Measures, there is no need for their implementing Terms and Conditions

If the incidental take anticipated in the paragraph entitled "Amount or Extent of Take is met, the Fort shall immediately notify the FWS in writing. If, during the course of the action, the level of anticipated incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation. In the interim, the Fort must cease the activity resulting in the take if it is determined that the impact of additional taking will cause an irreversible and adverse impact on the species. Fort Huachuca must immediately provide an explanation of the causes of the taking and review with the FWS the need for possible modification of the reasonable and prudent measures.

Conservation Recommendations

See the Conservation Recommendations section for the Huachuca water umbel, above, for information regarding the statute and policy governing Fort Huachuca's implementation of the following recommendations:

1. The Fort should study the movements and habitat use of terrestrial salamanders in and near Upper Garden Canyon Pond.

2. The Fort should continue to actively participate in the preparation and implementation of the Sonora Tiger Salamander Recovery Plan.

3. If the Sonora tiger salamander is found breeding at sites other than Upper Garden Canyon Pond on Fort Huachuca, the Fort should, in accordance with 50 CFR 402.16(b), reinitiate this consultation, if this would represent new information revealing that the effects of the action may affect the salamander in a manner or to an extent not considered herein.

For the FWS to be kept informed of actions minimizing or avoiding adverse effects to or benefiting listed species or their habitat, we request notification of the implementation of any conservation recommendations.

Please note that surveys for Sonora tiger salamander that involve capture or take require appropriate permits from the FWS and Arizona Game and Fish Department.)

Reporting Requirements/Disposition of Dead or Injured Listed Animals

Upon finding a dead or injured threatened or endangered animal, initial notification must be made to the FWS's Division of Law Enforcement, 2450 West Broadway, Mesa, Arizona (480-967-7900) within three working days of its finding. Written notification must be made within five calendar days and include the date, time, and location of the animal, a photograph, and any other pertinent information. Care must be taken in handling injured animals to ensure effective treatment and care, and in handling dead specimens to preserve biological material in the best possible condition. If feasible, the remains of intact specimens of listed animal species shall be submitted as soon as possible to the nearest FWS or AGFD office, educational, or research institutions (e.g., University of Arizona in Tucson) holding appropriate state and Federal permits.

Arrangements regarding proper disposition of potential museum specimens shall be made with the institution before implementation of the action. A qualified biologist should transport injured animals to a qualified veterinarian. Should any treated listed animal survive, the FWS should be contacted regarding the final disposition of the animal.

REINITIATION AND CLOSING STATEMENT

This concludes formal consultation on the Department of the Army's proposed land use, military operations, and training range utilization at and near Fort Huachuca, Arizona, for 10 years. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been maintained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may adversely affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to a listed species or critical habitat that was not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by this action.

The anticipated publication of the U.S. Geological Survey Sierra Vista Subwatershed model by Don Pool is relevant to reinitiation criterion 2, above. Specifically, should any model scenarios that reasonably reflect the ground water impacts of the proposed action show that impacts to

surface flow in the San Pedro and/or Babocomari rivers are greater than those analyzed herein, and/or should those effects display differences in their spatial and/or temporal distributions relative to those analyzed herein, we recommend that Fort Huachuca immediately reanalyze the effects of the proposed action and, if warranted, consider reinitiation of formal consultation.

In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation, if it is determined that the impact of such taking will cause an irreversible and adverse impact to the species. Any questions or comments should be directed to Jason Douglas (520) 670-6150, (x226) or Sherry Barrett (520) 670-6150, (x223)

Sincerely,

Steven L. Spangle
Field Supervisor

cc: Assistant Regional Director, Fish and Wildlife Service, Albuquerque, NM (Attn: Susan Jacobsen)
Assistant Field Supervisor, Fish and Wildlife Service, Tucson, AZ
Robert Bridges, Environment and Natural Resource Division, Fort Huachuca, AZ
Chief, Habitat Branch, Arizona Game and Fish Department, Phoenix, AZ
Regional Manager, Arizona Game and Fish Department, Tucson, AZ

APPENDIX A: CONCURRENCES

This appendix contains background information and our concurrence with your determination that the proposed ongoing and future military operations and activities at Fort Huachuca, Arizona may affect, but are not likely to adversely affect, the endangered Canelo Hills ladies' tresses (*Spiranthes delitescens*), the threatened bald eagle (*Haliaeetus leucocephalus*), the endangered jaguar (*Panthera onca*), the threatened spikedace (*Meda fulgida*) with critical habitat, the endangered Gila topminnow (*Poeciliopsis occidentalis occidentalis*), and the endangered desert pupfish (*Cyprinodon macularius*).

Canelo Hills Ladies' Tresses

Status of the Species in the Action Area

This species is known from five sites at about 5,000 feet elevation in the San Pedro River watershed in Santa Cruz and Cochise counties, southern Arizona (Newman 1991; Mima Falk, pers. comm., 1996 as cited in the Revised PBA). The total amount of occupied habitat is less than 200 acres. Four of the populations are on private land less than 23 miles north of the U.S. and Mexico border; one additional small site containing four individuals was discovered on public land in 1996 (Mima Falk, pers. comm., 1996 as cited in the Revised PBA). This site is located near a known population and may not be a distinct population. Potential habitat in Sonora, Mexico, has been surveyed but no *Spiranthes delitescens* populations have been found.

Four of the five populations of Canelo Hills ladies' tresses occur to the west of Fort Huachuca. These populations occur on Nature Conservancy, Forest Service (Coronado National Forest), and private land (Arizona Rare Plant Committee 2001). The fifth population occurs on private land at the Babocomari Cienega, about 1.5 miles north of the northwest corner of Fort Huachuca. Threats to the Canelo Hills ladies' tresses include ground water pumping, water diversions, sand and gravel mining, recreation impacts, illegal collection, and invasion of cienega habitats by nonindigenous plant species, such as Johnson grass (*Sorghum halepense*) and Bermuda grass (*Cynodon dactylon*) (FWS 1997a). The nonindigenous Johnson grass is invading one *Spiranthes* site (Dave Gori, Arizona Nature Conservancy, in litt. 1993). This tall grass forms a dense monoculture, displacing less competitive native plants. If Johnson grass continues to spread, the Canelo Hills ladies'-tresses population at this site may be lost (Dave Gori, in litt. 1993). The effect of livestock grazing on the Canelo Hills ladies'-tresses is unclear. A *Spiranthes* population growing at a site grazed for more than 100 years was found to be larger and more vigorous than a population growing at a site ungrazed since 1969 (McClaran and Sundt 1992, Newman 1991).

Limited numbers of populations and individuals threaten this taxon with demographic and environmental extinction as a result of stochastic events that are often exacerbated by habitat disturbance. For instance, the restriction of the species to a relatively small area in southeastern Arizona increases the chance that a single environmental catastrophe, such as a severe tropical storm or drought could eliminate populations or cause extinction.

Effects of the Proposed Action

The potential effects of ground water use on the Babocomari Cienega were evaluated in the southwestern willow flycatcher Effects of the Proposed Action section. Based on available data,

it is unlikely that ground water pumping by Fort Huachuca or Sierra Vista currently affects, or in the future would affect, riparian or wetland habitat at or near the cienega. This conclusion is based on: (1) the cienega being upstream of wells at Fort Huachuca and Sierra Vista; (2) faulting and geology suggests much of the water in the area comes from the Mustang Mountains (Houser 1998); (3) a geological feature that forces ground water to the surface at this site (ADWR 1991); (4) the fact that the Babocomari River flows from the west; (5) Fort Huachuca will implement conservation measures to nearly completely minimize their net removal of ground water from storage and their capture of discharge; (6) Fort Huachuca will request that the communities and agencies within the Sierra Vista Subwatershed, through the USPP, make a commitment to offset the cumulative (non-Federal) effects associated with ground water overdraft by 2011 as well.

The chance of fire spreading from the northwestern installation boundary to the Babocomari Cienega is unlikely because of sparse and fine fuels between the installation boundary and the cienega. Also, the Fort's perimeter road and fuel breaks located in Training Area Juliet reduce the likelihood for fire to spread off the installation. Fire may be beneficial to this species.

Conclusion

The FWS concurs with the Fort's determination that the proposed action may affect, but is not likely to adversely affect the Canelo Hills ladies'-tresses. We base this determination on the following:

1. Although all five populations of Canelo Hills ladies'-tresses occur near Fort Huachuca, none occur on the Fort or in areas proposed for off-post activities;

2. Available hydrological information suggests that ground water pumping by Fort Huachuca is not likely to affect Canelo Hills ladies'-tresses habitat at Babocomari Cienega; and

3. The probability of other activities of Fort Huachuca, such as fires ignited on the West Range or aircraft crashes adversely affecting the Canelo Hills ladies' tresses is remote. Fire may be beneficial to Canelo Hills ladies' tresses.

<u>Bald eagle</u>

Status of the Species in the Action Area

The bald eagle does not nest in Arizona south of the Gila River, and is very rarely seen during the summer. Consistent wintering areas have not been documented in southeastern Arizona during statewide, yearly winter surveys (Beatty 1997 in litt.). However, in southeastern Arizona, the species is known to occur in winter in the Sulphur Springs Valley and has been observed at Parker Canyon Lake. No suitable nesting habitat or habitat for congregations of wintering birds exists on Fort Huachuca.

Effects of the Proposed Action

The bald eagle is only a transient visitor to Fort Huachuca during the winter months; direct mortality is therefore unlikely. A bald eagle could collide with the Bergey wind turbine on the

West Range or possibly with a vehicle, wind data tower or other man-made structure, but the possibility is low. If direct mortality of a bald eagle is detected, the Fort will enter into formal consultation. The lack of wintering or roosting habitat on or near the Fort precludes effects to potential or suitable bald eagle habitat.

Conclusion

The FWS concurs with the Fort's determination that the proposed action may affect, but is not likely to adversely affect the bald eagle. This concurrence is based on the following:

1. There are no known nesting or roost sites nearby, therefore no disturbance of such sites is occurring;

2. Bald eagles rarely occur in southeastern Arizona; and

3. The chance that a bald eagle would be harmed by the proposed action is remote.

Jaguar

Brown (1983) presented an analysis suggesting there was a resident breeding population of jaguars in the southwestern United States at least into the 20th century. The FWS (2006) recognizes that the jaguar continues to occur in the American Southwest, at least as an occasional wanderer from Mexico. Goldman (1932) believed the jaguar was a regular, but not abundant, resident in southeastern Arizona. Hoffmeister (1986) considered the jaguar an uncommon resident species in Arizona. He concluded that the reports of jaguars between 1885 and 1965 indicated that a small but resident population once occurred in southeastern Arizona.

Brown (1983) suggested that the jaguar in Arizona ranged widely throughout a variety of habitats from Sonoran desertscrub upward through subalpine conifer forest. Most of the records were from Madrean evergreen-woodland, shrub-invaded semidesert grassland, and along rivers. The AGFD (1998) cited two recent reports of jaguars in Arizona. The individuals were regarded as transients from Mexico. One of the reports was from 1987 from an undisclosed location. The other report was from 1988, when tracks were observed for several days before the treeing of a jaguar by hounds in the Altar Valley, Pima County. An unconfirmed report of a jaguar at the Coronado National Memorial was made in 1991 (Ed Lopez, Coronado National Memorial, pers. comm. 1992 *in litt.* as cited in the Revised PBA; FWS 1997c). In 1993, an unconfirmed sighting of a jaguar was reported for BANWR (William Kuvlesky, pers. comm. as cited in the Revised PBA; FWS *in litt.*; FWS 1997c).

Recently (1996 through 2006), possibly five transient male jaguars have been documented in the United States. Of those five, in 1996, two male jaguars were photographed in the United States: one on March 7, 1996, in the Peloncillo Mountains, located along the Arizona-New Mexico border (Glenn 1996; Brown and Lopez Gonzalez 2001), and another on August 31, 1996, in the Baboquivari Mountains in southern Arizona (Childs 1998; Brown and Lopez Gonzalez 2001). In February 2006, a jaguar was observed and photographed in Hidalgo County, New Mexico. Using remote cameras, jaguars were photographed in the United States near the Arizona-Sonora, Mexico border beginning in 2001, and as recently as April 2006.

Because regional jaguar sightings are rare, the probability of jaguars occurring within Fort Huachuca is low.

Effects of the Proposed Action

Although no confirmed sightings of a jaguar have occurred on Fort Huachuca, the availability of suitable jaguar habitat in the Huachuca Mountains and the observations of the species to both the east and west suggests that the species may occur on the installation in the future if regional jaguar populations increase. Suitable habitat includes about 23,300 acres of oak-grass savanna, oak woodlands, mixed woodlands, mahogany woodlands, and conifer woodlands on the South and West Ranges. Proposed construction activities would not disturb these habitat types. Few operational activities take place in these areas; thus, the potential for direct mortality would be limited to collisions with vehicles that infrequently travel these areas, or with recreational vehicles that use the canyons. Recreational activity is not permitted beyond the cantonment area at night, when jaguars are most active, so the overall risk of jaguars colliding with vehicles would be negligible. Suitable habitat for the jaguar could potentially be affected by wildland fire, prescribed fire or managed natural fire. Such fires could result in loss of foraging or denning habitat. However, the Fort's commitment to fire prevention, prescribed burning, and fire suppression procedures outlined in fire-related subsection of the Description of the Proposed Conservation Measures section of this biological opinion, particularly in wooded habitat, reduces the potential for fire to adversely affect the jaguar and its habitat.

Conclusion

The FWS concurs with the Fort's determination that the proposed action may affect, but is not likely to adversely affect the jaguar for the following reasons:

1. No jaguar has been recorded in the area and they are unlikely to occur for any length of time;

2. Suitable dispersal habitat may be present, but habitat for resident jaguars is minimal at best;

3. Dispersal habitat will be maintained; and

4. Expected levels of use and activity are not expected to discourage use of the area for jaguar movement.

<u>Spikedace</u>

Status of the Species in the Action Area

Spikedace are a small silvery fish whose common name alludes to the well-developed spine in he dorsal fin (Minckley 1973). Spikedace historically occurred throughout the mid-elevations of the Gila River drainage, but is currently known only from Aravaipa Creek (Graham and Pinal Counties, Arizona), the upper Gila River (Grant and Catron Counties, New Mexico), the middle Gila River (Pinal County, Arizona), Eagle Creek (Greenlee County, Arizona), and the Verde River (Yavapai County, Arizona)(Barber and Minckley 1966, Minckley 1973, Barrett *et al.*

1985, Bestgen 1985, Marsh *et al.* 1990, Sublette *et al.* 1990, Jakle 1992, Knowles 1994). Habitat destruction, and competition and predation from introduced nonindigenous fish species are the primary causes of the species decline (Miller 1961, Williams *et al.* 1985, FWS 1986, Douglas *et al.* 1994).

Spikedace are not currently known from Fort Huachuca or the upper San Pedro River basin (Sally Stefferud, FWS, Phoenix, pers. comm. 1998 as cited in the Revised PBA); however, the species occurred in the upper San Pedro River historically (U.S. BLM 1998). Spikedace occur in Aravaipa Creek, in suitable habitat throughout the area of perennial flow (Barber and Minckley 1966, Minckley 1973, Velasco 1994). For several years spikedace were thought to be extirpated in the San Pedro River and middle reaches of the Gila River (between Coolidge and Ashurst-Hayden Dams) systems with the exception of Aravaipa Creek. However in 1991, a single spikedace was collected in the Gila River near Florence (Jakle 1992), suggesting the species may occur elsewhere on the Gila and lower San Pedro Rivers downstream of the Aravaipa confluence.

When spikedace populations are at low levels, they can be very difficult to locate. Fish sampling data from the lower San Pedro and middle Gila Rivers is limited and localized. Perennial flows in the Gila River, perennial and ephemeral flows that connect reaches of the San Pedro River with the Gila River and Aravaipa Creek, and the spikedace record at Cochran Crossing suggest that a small number of spikedace may be present on the lower San Pedro River from the Aravaipa confluence to Dudleyville, and possibly downstream on the middle Gila River. Based on findings for other native fish in these reaches, numbers of spikedace may increase temporarily in this area following flood events.

Although the species is currently thought to be extirpated, the upper San Pedro River is considered important recovery habitat for the spikedace. A number of agencies have been working toward native fish recovery in the San Pedro River. The BLM's management plan for the San Pedro RNCA calls for "reintroduction of native wildlife species, including threatened and endangered species, as well as for consideration of "removal of exotic fish from existing ponds (BLM 1989). BLM's habitat management plan for the area contains specific objectives for reestablishing spikedace. Funding is available through the Bureau of Reclamation as a result of the Central Arizona Project jeopardy biological opinion to remove nonindigenous fish from Kingfisher or Young-Block ponds near the Highway 90 crossing, as well as other measures needed to reduce nonindigenous species and reestablish native fishes into the San Pedro RNCA. The most likely sites for such reestablishments appear to be springs within tributaries to the mainstem San Pedro River.

Effects of the Proposed Action

The Fort's proposed action does not include activities on Aravaipa Creek or at other spikedace localities, thus no direct effects would occur. However, as discussed in the biological opinion's Effects of the Proposed Action for the southwestern willow flycatcher, the upper and lower reaches of the San Pedro River are hydrologically connected, so that effects in the upper basin could potentially affect flows and riparian habitat in the lower basin. If ground water pumping attributable to the Fort caused a reduction in flows on the lower San Pedro River, the spikedace could potentially be adversely affected. This possibility was examined in the Effects of the Proposed Action for the flycatcher. In that discussion, we concluded that ground water pumping

in the upper basin would not significantly affect flows in the lower basin for the following reasons: (1) flood flows are not affected by ground water pumping, (2) the projected baseflow flow reductions attributable to the Fort are of insufficient magnitude to be capable of reaching across subwatershed boundaries; (3) the water budget prepared by ADWR (1991) estimates that little to no ground water inflow occurs into the Benson subwatershed from the Sierra Vista Subwatershed, (4) conservation measures included in the proposed action will minimize effects to ground water in the Sierra Vista Subwatershed; and (5) ground water inflow across subwatershed boundaries in the lower San Pedro River is also insignificant (ADWR 1991).

Ground-water flow between subwatersheds might be greater if water use did not exceed water supply in the Sierra Vista Subwatershed, but because of the presence of cones of depression it is unlikely that any increased water supply would result in significant increases in subwatershed outflow. Even if the entire deficit was discharged as outflow from the Sierra Vista Subwatershed, only 18 percent of that figure would be expected to reach the Winkelman subwatershed. Annual water supply to the Winkelman subwatershed is 73,760 ac-ft, thus under this scenario, eliminating the deficit in the Sierra Vista Subwatershed and diverting all of the gain to subwatershed outflow would cause no more than approximately 2 percent increase in annual inflow into the Winkelman subwatershed, under the most optimistic conditions.

Although the effects of ground water pumping in the Sierra Vista Subwatershed on potential downstream spikedace habitat are uncertain, the best information available suggests that currently these effects are probably small or negligible. Effects of future ground water pumping are predicted to be insignificant because base flow into the subwatershed where spikedace may occur is very small.

As discussed for the Huachuca water umbel and the southwestern willow flycatcher, if unmitigated ground water pumping by Fort Huachuca and other water users in the Sierra Vista Subwatershed is in excess of supply, and particularly if monsoon runoff is appreciably diminished, it will eventually lead to diminished surface flows in portions of the upper San Pedro River and loss of recovery habitat and opportunities for the spikedace (see Huachuca water umbel section for detailed discussion). However, ground water use attributable to Fort Huachuca in the subwatershed has been minimized, as described in this biological opinion. Fort Huachuca will also continue to request that the communities and agencies within the Sierra Vista Subwatershed, through the USPP, make a commitment to offset the cumulative effects associated with ground water usage by 2016 as well. It is expected that implementation of Fort Huachuca water conservation measures will be successful in minimizing the installation's adverse effects to the San Pedro River.

Also discussed previously, without a concerted effort to decrease the effects of net pumping or otherwise minimize the effects of ground water pumping, de-watering and loss of riparian vegetation is possible on portions of the San Pedro River. The habitat north of Charleston, particularly near the Babocomari confluence, is most at risk, followed by the reach from Highway 90 to Charleston. Evidence suggests that de-watering is already occurring, although the cause is unclear and may or may not currently be attributable to effects of the action (ADWR 1994, ASL 1994, Water and Environmental Systems Technology, Inc. 1996, Sharma *et al.* 1997, Fenske 1998, Koehler and Ball 1998, Pool *et al.* 1998, MacNish 1998, SAIC 1998b, San Pedro Expert Study Team 1999, Koehler 2004; Corell *et al.* 1996; Pool and Coes 1999; Thomas and

Pool 2006. Of particular concern is the potential for agricultural development near the river, which could result in de-watering the San Pedro River from Hereford to Highway 90.

Wildfires ignited by recreational users or ordnance, prescribed fire, and fire suppression activities could result in direct effects to spikedace critical habitat. Indirect effects could also occur from these activities, particularly as a result of watershed degradation and subsequent erosion, sedimentation, and changes in stream hydrology. Wildfire on the East Range could escape fire suppression measures and spread into the San Pedro RNCA; however, the probability of this occurring is low. Fires started on the East Range are infrequent and there are no records of fires spreading to the San Pedro RNCA. In addition, if a fire did start in the East Range, it would not likely spread far because of low fuel loads.

Erosion within the East Range is the highest on the installation, with sheet and rill erosion in the central part of the range the most significant. Through analysis and field observation, the majority of sediment from areas within the central zone of the East Range is deposited within the respective stream channels on the installation (ENRD 1997). These findings suggest that, while significant erosion and sediment transfer continue to occur across the East Range, the extent of deposition is predominantly limited to areas within Fort Huachuca and not in the San Pedro RNCA.

Conclusion

The FWS concurs with the Fort's finding that the proposed action may affect, but is not likely to adversely affect the spikedace. We base this finding on the following:

1. The most important habitats and most significant population of spikedace in the San Pedro River watershed are in Aravaipa Creek, which should not be affected by ground water pumping or other activities in the proposed action.

2. With prompt development and implementation of ground water management measures, as proposed by Fort Huachuca, ground water pumping attributable to the proposed action is unlikely to have appreciable effects on flows in the lower San Pedro River.

3. Erosion and fire are unlikely to reach the San Pedro or the sites in which spikedace are reasonably likely to be reestablished.

<u>Gila Topminnow</u>

Status of the Species in the Action Area

In Arizona, the Gila topminnow was once common and abundant in the Rio Yaqui basin and the Gila River basin, including the San Pedro River until the mid to late 1970s (BLM 1989). The species has since declined throughout its range.

Translocation of the Gila topminnow in Arizona has been successful in restoring populations and establishing new ones in some areas (NMDGF 1996). Since the 1960s, 180 translocations of the Gila topminnow have occurred throughout its historic range. Thirty-seven of these reestablishments have occurred on Fort Huachuca, Aravaipa Creek, and Babocomari Creek; all

of these reestablished population have since disappeared (SFB 1996). However, the Gila topminnow now occurs in 11 indigenous localities in southern Arizona. All but a few populations are considered to be in danger of extirpation (SFB 1996).

Although the Gila topminnow is not included on the FWS Cochise County list of Threatened and Endangered Species, it is proposed to be re-introduced into springs within tributaries to the upper San Pedro River within the San Pedro RNCA by the BLM, possibly within the spring of 2008, and therefore it is included in this biological opinion's concurrence appendix (BLM 2006). Note that though the BLM's action may be delayed, it is still reasonably certain to occur prior to 2016.

Effects of the Proposed Action

Potential threats to the Gila topminnow, if reestablished by the BLM into the upper San Pedro River and/or adjacent springs within the San Pedro RNCA, include fire, erosion, human disturbance and the pumping of ground water.

The Fort's proposed action does not include activities on the Santa Cruz River or at other Gila topminnow localities outside of the San Pedro River, thus no direct effects to the species in those areas would occur. As discussed in the southwestern willow flycatcher section, the upper and lower reaches of the San Pedro River are hydrologically connected, so that effects in the upper basin could potentially affect flows and riparian habitat in the lower basin. If ground water pumping attributable to the Fort caused a reduction in flows on the upper San Pedro River, the Gila topminnow could potentially be adversely affected.

Groundwater flow between subwatersheds might be greater if water use did not exceed water supply in the Sierra Vista Subwatershed, but because of the presence of a cone of depression, it is unlikely that any increased water supply would result in significant increases in subwatershed outflow. Even if the entire deficit was discharged as outflow from the subwatershed, this would only account for approximately 15 percent of the water supply in the Benson subwatershed. Although the effects of ground water pumping in the Sierra Vista Subwatershed on potential downstream Gila topminnow habitat are uncertain, the best information available suggests that currently these effects are probably small or negligible. Effects of future ground water pumping are predicted to be insignificant because baseflow into the subwatershed where Gila topminnow may occur is very small. Moreover, by implementing Fort Huachuca's conservation measures, potential effects of water use will continue to decline by the year 2016.

As discussed in the Huachuca Water Umbel section, ground water pumping in excess of recharge would, in time, result in loss of the Gila topminnow, if reestablished, from portions of the San Pedro River. However, Fort Huachuca has agreed to reduce effects of its proposed action, as well as the effects of interrelated and interdependent actions, by 2016. In addition, Fort Huachuca will continue to work with communities and agencies within the Sierra Vista Subwatershed, through the USPP, to mitigate the cumulative effects associated with ground water use in the Sierra Vista Subwatershed. It is expected that implementation of Fort Huachuca water conservation measures and regional water resources planning and implementation efforts will be successful in mitigating potential adverse effects to the San Pedro River and Gila topminnow recovery habitat.

Wildfire ignited by recreational users or ordnance, prescribed fire, and fire suppression activities could result in direct effects to the Gila topminnow, if reintroduced into the upper San Pedro River. Indirect effects could occur from other activities, particularly as a result of watershed degradation and subsequent erosion, sedimentation, and changes in stream hydrology. Wildfire on the East Range could escape fire suppression measures and spread into the SPRNCA; however, the probability of this occurring is low. Fires started on the East Range are infrequent and there are no records of fires spreading to the San Pedro RNCA. In addition, if a fire did start in the East Range, it would not likely spread far because of low fuel loads in the Chihuahua desert shrub habitat.

Erosion within the East Range is the highest on the installation, with sheet and rill erosion within the central portion of the range the most significant. Through analysis and field observation, the majority of sediment from areas within the central zone of the East Range is deposited within the respective stream channels on the installation (ENRD 1997). These findings suggest that, while significant erosion and sediment transfer continue to occur across the East Range, the extent of deposition is predominantly limited to areas within Fort Huachuca and not in the adjacent SPRNCA.

Fort Huachuca conservation measures would improve degraded watershed conditions on the East Range and address fire and ground water threats to the species and its proposed critical habitat (see the Description of the Proposed Conservation Measures section of this biological opinion).

Overall, ongoing and future military operations and activities at and near Fort Huachuca, to include ground water usage, may affect, but are not likely to adversely affect the Gila topminnow, if reestablished into the San Pedro River.

Conclusion

The FWS concurs with the Fort's determination that the proposed action may affect, but is not likely to adversely affect the Gila topminnow. We base this determination on the following:

1. Gila topminnow likely to be reestablished by the BLM within the San Pedro RNCA are not likely to experience appreciably diminished base flows;

2. The effects of Fort Huachuca's fire management plan are not expected to affect Gila topminnow due to the Fort's relatively long distance from the San Pedro River and the low fuel loading between the river and the installation; and

3. Erosion from Fort Huachuca's East Range is unlikely to result in increased sedimentation in the San Pedro River.

<u>Desert Pupfish</u>

Status of the Species in the Action Area

Only one indigenous population of desert pupfish exists in Arizona at the Quitobaquito Spring (SFB 1996). Endeavors to reestablish the desert pupfish have been made in a number of locations throughout Arizona, including three unsuccessful reintroductions on Fort Huachuca at Boston

Water Catchment and Kino Springs in 1982, and Buffalo Corral Spring in 1988 (SFB 1996). No reestablishment efforts have been made within the San Pedro River due to lack of suitable habitat and exotic fish predators (SFB 1996).

In Arizona, future reestablishment actions will be located within the Gila, Hassayampa, Agua Frio, San Pedro, Santa Cruz, Salt, and Verde River drainages (FWS 1993).

Although the desert pupfish is not included on the FWS Cochise County list of Threatened and Endangered Species, it is proposed to be re-introduced into springs within tributaries to the upper San Pedro River within the San Pedro RNCA by the BLM, possibly within the spring of 2008, and therefore it is included in this biological opinion's concurrence appendix (BLM 2006). Note that though the BLM's action may be delayed, it is still reasonably certain to occur prior to 2016.

Effects of the Proposed Action

Potential threats to the desert pupfish, if reintroduced by the BLM into the upper San Pedro River and/or adjacent springs within the San Pedro RNCA, include fire, erosion, human disturbance and the pumping of ground water.

The effects of the proposed action to desert pupfish are similar to those for Gila topminnow, above, and are incorporated herein via reference.

Conclusion

The FWS concurs with the Fort's determination that the proposed action may affect, but is not likely to adversely affect the desert pupfish. We base this determination on the following:

1. Desert pupfish likely to be reestablished by the BLM within the springs within the San Pedro RNCA are not likely to experience appreciably diminished base flows;

2. The effects of Fort Huachuca's fire management plan are not expected to affect desert pupfish due to the Fort's relatively long distance from the San Pedro River and the low fuel loading between the river and the installation; and

3. Erosion from Fort Huachuca's East Range is unlikely to result in increased sedimentation in the San Pedro River.

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